FIRE MANAGEMENT PLAN
ENVIRONMENTAL ASSESSMENT

HOPEWELL CULTURE NATIONAL HISTORICAL PARK

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INTRODUCTION

From about 200 BC to AD 500, the Ohio River Valley was a focal point of the prehistoric Hopewell culture. The term Hopewell describes a broad network of beliefs and practices among different Native American groups over a large portion of eastern North America. The culture is characterized by the construction of enclosures made of earthen walls, often built in geometric patterns, and mounds of various shapes. Visible remnants of Hopewell culture are concentrated in the Scioto River Valley.

Ross County was settled by Euro-Americans in 1796 and developed soon after into fertile farmland. By the mid 1800s, some damage to the earthworks had already occurred. "The operations of the elements, the shifting channels of the streams, the levelling hand of public improvement, and the most efficient of all, the slow but constant encroachment of agriculture, are fast destroying these monuments of ancient labor" (Squier and Davis 1848:xxxix).

Hopewell Culture National Historical Park (NHP) located in Chillicothe, Ohio, was first established as Mound City Group National Monument in 1923. President Warren G. Harding's proclamation establishing the park gives the purpose and significance of the Mound City Group of prehistoric mounds as:

> "... an object of great historic and scientific interest [that] should be permanently preserved and protected from all depredations and from all changes that will to any extent mar or jeopardize their historic value..."

The custody of the national monument began with the Veterans' Bureau, but once established as a National Monument was transferred to the War Department. Under an agreement with the War Department, the Ohio State Historical and Archeological Society managed the site until 1946 when its administration was finally transferred to the National Park Service.

Hopewell Culture National Historical Park (Hopewell Culture) was established May 27, 1992 when President George H. W. Bush signed Public Law 102-294 renaming the Mound City Group National Monument and authorizing the acquisition of three additional Hopewell sites in Ross County. The new name recognized the larger size and greater complexity of the park resulting from the addition of these new culturally rich areas. Earlier in May 1980, P.L. 96-607 authorized the addition of 150 acres of the Hopeton Earthworks to the monument. These changes bring the current park total to 1,169.96 acres. At present, the park consists of five noncontiguous sites: Mound City Group, Hopewell Mound Group, Hopeton Earthworks, portions of the High Bank Works, and Seip Earthworks, which is partially owned by the Ohio Historical Society.

All of the park's sites are complex earthworks that represent some of the most significant Hopewell sites in Ohio, and perhaps all of North America. The widely varying sites may have had different purposes from those represented by the original park at Mound City Group. The 1992 legislation recognizes preservation of these sites as essential to understanding and interpreting the story of the Ohio Hopewell culture.

Background

The park's 1997 General Management Plan (GMP) states that the park purpose is to:

- Preserve, protect, and interpret the remnants of a group of once extensive archeological resources that might be lost if not protected, including mounds and earthworks, artifacts, the archeological context, the cultural landscape, and ethnographic information.

- Promote cultural resource stewardship and understanding of the importance of the resources to present and future generations.

- Promote, coordinate, conduct, and synthesize anthropological research that focuses on the major questions about the Hopewell culture.

- Educate the public about the Hopewell people's daily lives, contributions, perceived values, and dealings with other peoples and the environment around them.

- Understand past societies and foster an appreciation of past, present, and future societies.

The GMP's preferred alternative proposed to uphold the purpose as described above by establishing a program that integrates the desired visitor experience, resource protection goals, and the potential for ongoing archeological and scientific research.

Park-wide treatment goals for the earthworks include:

- Preserve original structures, artifacts, materials, and other archeological information and research opportunities.

- Respect the heritage of the peoples of the Hopewell culture.

- Enable visitors of diverse backgrounds to experience, comprehend, appreciate, and care about the heritage of the Hopewell culture.

- Adhere to the Secretary of the Interior's Standards for Archeology and Historic Preservation in treatment design.

- Design treatment strategies that are suited to the characteristics of each structure, and are sustainable within projected trends for budget and staffing.

Clearly, the focus of the park is and should be the protection and preservation of the earthworks and artifacts associated with the Hopewell culture, and the interpretation of those resources.

The GMP calls for the "…earthworks [to be] protected by a low, mown vegetation cover or other vegetation that promotes resource protection, and integrated pest management measures will be used to control animals and insects as necessary. Woody vegetation will be cleared in the

pedestrian zone up to and on the existing wall remnants. Vegetation that can threaten the structural integrity of the earthworks will be selectively thinned or removed." It also concluded that prescribed fire may serve as an important tool to manage vegetation, but more research was needed to definitively assess the direct effects of fire on the cultural resources in the park, as well as the indirect effects of fire on ongoing and future archeological research.

Although the GMP expresses the need for a Cultural Landscape Report (CLR), NPS managers have determined that existing data about the prehistoric and historic character of the earthwork sites is insufficient. Until more is known, treatment guidelines typically provided in a CLR are premature. Treatment decisions based on insufficient or erroneous data could preclude the ability to fashion more appropriate recommendations in the future.

It is likely that vegetation was highly manipulated by those of the Hopewell culture. By the time Ross County was surveyed in the 1840s, forest growth covered much of the earthwork sites. Because vegetative cover of the sites has varied widely over time, there is no single period that should or could be accurately recreated, using existing data.

In 1995 (revised 1997), the park developed a Resource Management Plan (RMP) that addressed many of the details and numerous aspects of preservation, protection and interpretation of the parks natural and cultural resources including the management of vegetation on and around the earthworks. It also recognized the possibility of utilizing prescribed fire as a vegetation management tool if it is found to be compatible with the preservation of the earthworks and other cultural resources, and does not interrupt or interfere with ongoing or future archeological research. It suggested that prescribed fire could and should be used on an occasional trial basis in selected areas of the park in order to evaluate its effectiveness and performance as a vegetation management tool.

According to the draft Vegetation Management Plan (VMP), the desired future condition is an established, sustainable groundcover dominated by native grasses and non-invasive exotics that allows for ongoing archeological preservation, research, and interpretation. It states "The optimal approach for interim, and possibly long-term, management of vegetation on the park's earthwork sites is a combination of mowing and very limited herbicide application." Furthermore, "If appropriate research is completed, the vegetation management program could also incorporate prescribed fire in select locations." This approach is similar to that taken at Valley Forge National Historical Park, where earthwork sites were successfully converted from turf to a mix of tall grasses and forbs.

The park desires to use prescribed fire on a limited experimental basis to evaluate its effectiveness as a vegetation management tool and to measure and establish its impact on the earthworks, other cultural resources, and ongoing research activities.

The National Park Service's Director's Order 18 (DO-18) (Wildlife Fire Management) requires that "All NPS units with vegetation that can sustain fire must have a Fire Management Plan." There are acres of land within Hopewell Culture that are burnable. Land that can sustain fire is covered with vegetation that consists of grasses and forbs, deciduous trees and shrubs, agricultural fields, and a few wetlands.

DO-18 further states that “The overall resource management objectives for an NPS unit must guide Fire Management Plans. The resource management objectives will determine whether and how fire will be managed.” To ensure that the protocols described in the Fire Management Plan (FMP) would address effects on natural and cultural resources, DO-18 requires that the FMP be compliant with the National Environment Policy Act. At Hopewell Culture, the use of prescribed fire as a resource management tool may play a role in meeting vegetation management objectives.

It is the policy of the National Park Service to allow natural processes to occur to the extent practical while meeting the park management objectives. NPS Management Policies (1988) state "Fire is a powerful phenomenon with the potential to drastically alter the vegetative cover of any park. Fire may contribute to or hinder the achievement of park objectives. Park fire management programs will be designed around resource management objectives and the various management zones of the park.” Specific guidance on wildland fire is further outlined in DO-18, (2003) and attendant Reference Manual, RM-18, (2004) for the National Park Service, as well as “The Wildland and Prescribed Fire Management Policy: Implementation and Reference Guide” (Zimmerman and Bunnell 1998).

In order to utilize prescribed fire as a vegetation management tool as outlined in the General Management Plan, Resource Management Plan, and draft Vegetation Management Plan, even on an experimental basis, Hopewell Culture must produce a Fire Management Plan. In addition, since the park contains burnable material in the form of natural vegetation, DO-18 requires that the Hopewell Culture develop a FMP that adopts all of its mandatory requirements and provisions.

Clearly, the previous planning efforts at Hopewell Culture anticipate the possibility of using prescribed fire as a tool for managing vegetation. This Environmental Assessment will evaluate the use of fire for managing and maintaining the grass covered earthworks and eliminating and preventing tree and shrub species from colonizing vulnerable areas. It will also consider the use of fire for hazard fuel reduction and evaluate the effects of wildland fire fighting activities.

One of the main benefits of developing a new FMP will be bringing Hopewell Culture into full compliance with all of the provisions of the new DO-18. It may allow for more flexibility of resource management alternatives and may help reestablish fire as a part of the natural vegetation cycle within the management areas. It may also allow for the future use of fire as a tool for hazard fuels management and for controlling or maintaining populations of invasive woody plants.

Purpose and Need

Purpose

This plan and the actions described address the role of fire in protecting Hopewell Culture National Historical Park’s significant archeological resources, fulfilling the goals of controlling detrimental nonnative vegetation and encouraging native vegetation, and protecting life and

property. The plan includes policies, procedures, interagency coordination, and objectives for wildfire control, fuel management, and fire response; and the plan considers the benefits and impacts of management-set prescribed fire.

Need

Hopewell Culture NHP has recently acquired about 800 acres in the five units of the park. Much of the land that was acquired was actively farmed, grazed, or cut for hay until recently. The Park's General Management Plan foresees conversion of these former agricultural lands into stable, permanent ground cover to protect the remains of the prehistoric earthworks. The General Management Plan also encourages the succession or introduction of native vegetation as the ground cover.

The conversion of these lands to grasslands also creates burnable vegetation. In the wake of a series of disastrous wildfires in the West and South in recent years, the Federal government has revised its fire management policies and procedures. In the National Park Service these policies are contained in DO-18. This policy requires that every park with burnable vegetation prepare a fire management plan to address resource management issues, life safety concerns, and fire response.

Scooping

Many of the topics addressed in this plan are driven by a national focus on disastrous wildland fires that have been difficult to control and have resulted in lost to homes and businesses with economic costs totaling millions of dollars; as well as the deaths of firefighters and members of the public. These national concerns have been incorporated into guidelines of the Department of the Interior and the National Park Service for preparing fire management plans.

In the early stages of preparation of this plan, the Park issued a news release and sent notification to each neighboring landowner. A copy of the news release is included in the **Summary of Public Involvement**. This effort resulted in one comment from a park neighbor. A copy of the notes of the phone conversation is included in the **Summary of Public Involvement**.

Scoping among Park staff brought up several issues. Succession of lands from fallow farm lands to native plant-dominated grasslands and control of woody vegetation was a major issue. Impacts to ground nesting birds were identified as an issue for both fire and mechanical control of fuels.

Park archeologists identified control of woody vegetation, impacts from fire fighting methods, and possible alteration of artifacts at the surface. They also expressed concerns with the impacts of the burns on the data obtained from the fluxgate magnetometer they use to survey for subsurface archeological features.

Park management raised concerns about funding required for fire suppression and prescribed fire implementation. Park management also expressed concern for possible hazards to neighboring properties.

IMPACT TOPICS

The National Environmental Policy Act or NEPA (42 U.S.C. 4321, as amended) requires Federal agencies to solicit input from potentially affected interests prior to making decisions on proposed actions that may affect the environment. An initial list of scoping issues for this EA was developed from input from park staff, Ohio State Historic Preservation Office (SHPO), National Park Service fire management specialists, and others.

Based on the above scoping process, the following issues have been identified and will be addressed in the EA:

1. Fire is a natural process and may be helpful in managing and maintaining vegetation on the mounds and earthworks.

2. Wildland and prescribed fires may adversely impact cultural resources and archeological research.

3. A Cultural Landscape Report has not been prepared, nor restoration objectives defined, for all cultural sites where prescribed fire use might be an effective management tool.

4. The effects of burning on data gathered by geophysical equipment, specifically magnetometry, used in non-destructive investigations at Hopewell sites have not been adequately assessed.

5. Potential air quality impacts of prescribed fire use need to be assessed.

6. The establishment of woody vegetation onto the earthworks threatens their integrity and the integrity of subsurface archeological resources.

Impact Topics Included in this EA

Impact topics allow comparison of the environmental consequences of implementing each alternative. Some impact topics are mandated for inclusion in an EA and others are derived from concerns expressed during the scoping process. A brief rationale for the inclusion of each impact topic is provided below.

Vegetation. Implementation of any of the alternatives will have an immediate and direct effect on the vegetation of the Park. The direct effects of fire on the vegetation of an area can be profound and evaluating the effects of fire on vegetation at the park is one of the stated goals of the FMP. Impacts to vegetation will be evaluated in this assessment.

Wildlife Communities. Implementation of the actions identified in the alternatives would result in changes in vegetation communities within the Park. This may indirectly affect wildlife populations that utilize these communities as their habitat. The direct effects of fire on wildlife will also be evaluated. This topic will be analyzed in the EA.

Threatened and Endangered Species. The Endangered Species Act of 1973 requires that federal agencies protect federally-listed threatened and endangered species and their habitats. Potential impacts of all federal actions on these species must be disclosed. Habitat for three federally-listed endangered wildlife species is also found within the park. Impacts on threatened and endangered species will, therefore, be addressed in this EA, and will include state species of concern or state threatened species.

Water Resources. NPS policies require protection of water resources consistent with the Clean Water Act. Park units are all located near water bodies, such as the Scioto River and Paint Creek, which is a tributary of the Scioto River. Major causes of degradation to the Scioto and other rivers in Ohio include sedimentation and pollution. The quality of the water in lakes, rivers, and streams is directly related to the condition of the watersheds they drain. Erosion-inducing activities, such as burning and firefighting in areas adjacent to streams, can affect the quality of the areas water resources. This impact topic will be addressed in this assessment.

Cultural Resources. Section 106 of the National Historic Preservation Act, as amended in 1992 (16 U.S. C. 470 et seq), and the NPS Cultural Resource Management Guidelines and Policies require the consideration of impacts on cultural resources listed, or eligible for listing, on the National Register of Historic Places. Since the alternatives in this EA consider strategies to use fire as a tool to restore the cultural landscape and to protect known cultural resources from adverse effects of fire, impacts to cultural resources will be analyzed.

Air Quality. The Federal Clean Air Act (42 U.S.C. 7401 et seq, as amended) stipulates that Federal land managers have an affirmative responsibility to protect a park's air quality from pollution. Hopewell Culture is designated a Class II area under the Clean Air Act and meets national ambient air quality standards for specified pollutants. Air quality would be affected to various degrees by smoke and particulates generated by fire events within the national park. Direct, indirect, and cumulative air quality impacts are, therefore, analyzed in this EA.

Park Facilities, Operations, and Visitor Use. Severe fires can directly and indirectly affect operations and threaten park or neighboring property and facilities. The alternative actions proposed in this plan could affect staffing, emergency response, and operational efficiency during fire events. In addition, proposed actions in the alternatives may temporarily affect visitor access, safety, recreational opportunities, and the character of the area. Analysis of this topic will be included in this EA.

Human Health and Safety. Fires can be hazardous, even life-threatening, to humans. Current Federal fire management policies emphasize that firefighter and public safety is the first priority; all FMPs must reflect this commitment (NIFC 1998). The EA will consider the impact of proposed alternatives on health and safety.

Impact Topics Considered but Dropped from Further Analysis

Some impact topics that are commonly considered were not relevant to this planning process or will not be substantially affected by any of the alternatives. The reasons for dropping these topics from consideration are provided below:

Wetlands. Executive Order 11990 ensures that the natural and beneficial values of wetlands will be preserved and enhanced. Although there are a few wetland areas in and around Park, the potential for adverse effects in such areas is low. Since there is no indication that wetlands would be affect by the proposed alternatives, this topic is not included for analysis.

Environmental Justice and Protection of Children. Executive Order 12898 requires federal agencies to identify and address disproportionately high and adverse health effects on minority and low-income populations, and to ensure that federal programs do not discriminate on the basis of race, color, or national origin. Executive Order 13045 requires Federal actions and policies to identify and address disproportionately adverse risks to the health and safety of children. Such populations are not likely in the project area to be impacted. Furthermore, none of the actions proposed in this plan would disproportionately impact minorities, children, or economically disadvantaged populations, so this topic is not being analyzed.

Soils and Topography. The actions proposed in the alternatives may result in short-term disturbance of soils in areas where there are fire events. Erosion potential is considered to be low due to the relatively level topography and degree of vegetation cover. No soil disturbing activities would be allowed within the park boundaries and this impact topic will not be addressed in this assessment.

Noise. Noise is defined as unwanted sound. Fuels reduction, prescribed burns, and fire suppression efforts can all involve the use of noise-generating mechanical tools and devices with engines, such as chain saws, trucks, helicopters, and airplanes. Each of these devices, in particular helicopters and chain saws at close range, are quite loud (in excess of 100 decibels). The use of machines, such as chainsaws, would be infrequent and not pervasive enough to substantially interfere with human activities in the area or with wildlife behavior. This impact topic is will not be addressed in this EA.

Socioeconomics. NEPA requires a consideration of impacts to the "human environment" which includes economic, social, and demographic elements in the affected area. Fire management activities may bring a short-term need for additional personnel in the park, but this addition would be minimal and would not affect neighboring communities' overall populations, incomes, and employment bases. Therefore, this impact topic is not included for further analysis in this EA.

Prime and Unique Agricultural Lands. Prime farmland has the best combination of physical and chemical characteristics for sustainable production of food, feed, forage, fiber, and oilseed crops. Unique land is land other than prime farmland that is used for production of specific high-value food and fiber crops. Both categories require that the land be available for farming uses. Lands

within the park are not available for farming and, therefore, do not meet these criteria. This impact topic is not evaluated further in this EA.

Indian Trust Resources. Indian trust resources are owned by Native Americans but held in trust by the United States. Indian trust resources do not occur within Hopewell Culture and none will be affected by any of the alternatives. This assessment will not evaluate Indian Trust Resources.

THE ALTERNATIVES

Alternative A – No Action

Under Alternative A, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. Vegetation and hazard fuel management would continue to be accomplished by mowing, hand cutting, stump treatments, and chemical spraying. Prescribed fires would not be allowed. The park would adopt the provisions and requirements of DO-18, and the park would be fully compliant.

Alternative B – Limited Prescribed fires (Preferred Alternative – Environmentally Preferred Alternative)

Under Alternative B, the Park would adopt a new FMP that encompasses all of the requirements and provisions outlined in DO-18. The majority of the vegetation management and hazard fuel management would continue to be accomplished by mowing, hand cutting, stump treatments, and chemical spraying, as in Alternative A. Prescribed fires would be allowed on a limited and fairly restricted basis, until the effects of fires on archeological resources and geophysical research can be evaluated. If fires are demonstrated to be safe for archeology and do not disrupt or appreciably affect data collection at the park, expanded prescribed fires would be considered and allowed on a case by case basis. The park would adopt the provisions and requirements of DO-18, and the park would be fully compliant.

Alternative Considered But Not Evaluated Further: Vegetation Management Predominated by Prescribed fires

Under this alternative the major technique for managing hazard fuels and invasive woody species would be the aggressive application of prescribed fires. Mowing would continue around buildings, on lawn areas, and around earthworks for interpretive purposes. The majority of the park would be burned on a regular repeating schedule of 3 to 5 years. Limited chemical herbicides would be allowed for those species that are not controlled by burning.

The 1997 GMP identified prescribed fire as a potential tool for managing vegetation, especially invasive woody species, on the fragile earthworks. This recognition of fire as a potential tool is repeated in the park's Resource Management Plan and Vegetation Management Plan. However, all three plans identify a lack of information regarding the effects of prescription fire on archeological resources and a need for further research before fire can be safely used for

managing vegetation at the park. There has also been some question regarding the effect fire may have on archeological research using geophysical techniques. In addition, the three plans all identify some reluctance to develop a fire dominated landscape while lacking a Cultural Landscape Report proposing any long term landscape goals.

There is also the problem of controlling woody vegetation in the Park, especially on the earthworks. The two most aggressively invasive woody species at the park and the most troublesome to the integrity of the earthworks are multiflora rose (*Rosa multiflora)* and shrub honeysuckle (*Lonicera sp.).* Neither of these species is reduced or checked by burning and some have reported increased vigor in plants following fire. It appears that the widespread use of prescribed fires may assist in the reestablishment or reinvigoration of many native grass and forb species, but it is unlikely to have an appreciable beneficial effect on reducing these woody invasive species and may actually promote their spread.

Because the effects of fire on the park's archeological resources and research data collection is unknown, the park wide application of prescribed fire without further research and analysis is specifically cautioned against in the GMP, RMP, and VMP. Recognizing this reluctance in previous plans, and in the absence of definitive research, the Park would not be willing to jeopardized nationally significant resources as long as other effective but less uncertain alternatives exist. For all of these reasons, Alternative C was not considered further in this assessment.

Common Elements of All Alternatives

Much of the current park management activities would continue under all alternatives. The primary focus for the management of the park will be the preservation and interpretation of the earthworks at the five park units and continuing research activities. All of the alternatives will continue with roughly the same vegetation management activities such as mowing, haying, herbicide applications, tree cutting and removal, hand cutting, etc. The major "on the ground" differences in activities are the activities associated with planning, preparing, and then carrying out prescribed fires allowed in Alternative B. However, the use of prescription fire under Alternative B will be limited to small study areas where fire has low potential for affecting archeology and high potential for evaluating its effects on resources and data collection. Areas to undergo prescribed fires under these conditions must have an inventory of cultural resources based on archeological survey and geophysical testing.

Table 1. Comparison of Alternatives

	Comply with DO-18?	Prescribed fires?	Mowing?	Chemical Herbicides?
Alternative A	Yes	No	Yes	Yes
Alternative B	Yes	Yes	Yes	Yes

Environmentally Preferred Alternative

The environmentally preferred alternative is the alternative that will promote the national environmental policy expressed in NEPA (Sec. 101 (b)). This includes an alternative that:

1. fulfills the responsibilities of each generation as trustee of the environment for succeeding generations;
2. assures for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
3. attains the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
4. preserves important historic, cultural, and natural aspects of our national heritage, and maintains, wherever possible, an environment which supports diversity and variety of individual choice; and
5. achieves a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and enhances the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

In other words, this is the alternative that causes the least damage to the biological and physical environment and that best protects, preserves, and enhances historic, cultural, and natural resources. In the NPS, the No Action Alternative may also be considered in identifying the environmentally preferred alternative. The two alternatives meet all of the goals outlined in NEPA (Sec. 101 (b)). Generally the difference in alternatives is measured in the degree to which each meets the goals.

The alternatives have similar elements and not widely varying effects. The major difference between them is the use of prescribed fires for hazard fuel reduction and vegetation management, which is allowed in Alternative B, and not Alternative A. However, even Alternative B allows for only limited use of prescribed fires. Generally they would be used primarily for evaluating the effects of fire on archeological resources and archeological research using geophysical techniques. If after careful evaluation, it is determined that prescription fire has no appreciable effect on resources or data collection, and the park would like to use it for hazard fuel reduction or vegetation management, the park can plan, prepare, and execute expanded prescribed fires in the Park. Mechanical and chemical treatments are likely to continue to varying degrees with the two alternatives.

Using prescription fire under Alternative B has the potential for some desirable effects for vegetation management not available under Alternative A. Fire has been shown to promote the return or re-dominance of many native vegetative species and, in some cases, reducing exotic invasive species. Such a reduction might allow vegetation managers to reduce the use of chemical herbicides as non-native species decline. However, fire is not likely to eliminate the need for chemical herbicides altogether, since the two major invasive species, multiflora rose (*Rosa multiflora)* and shrub honeysuckle (*Lonicera sp.),* are not eliminated by fire. It may,

however, allow managers to concentrate their efforts at reducing or eliminating these, and other troublesome species, as others affected by prescribed fire are controlled.

In addition, fire itself is increasingly recognized as an important natural tool for managing vegetation and landscapes in the Midwest. Alternative B allows the Park to evaluate the effectiveness and desirability of using this natural tool in managing vegetation in the park, especially around the earthworks. Alternative A does not allow for this flexibility in management and rely entirely on mechanical and chemical treatments for vegetation management. Because of this, Alternative B is considered to be the Environmentally Preferred Alternative, as well as the park's Preferred Alternative.

AFFECTED ENVIRONMENT

Hopewell Culture National Historical Park consists of five individual park units located around the town of Chillicothe in southern Ohio. Each of the units has been formally authorized for acquisition and encompass unique examples of Hopewell archeology. The units range in size from 120 to 375 acres and are in various stages of acquisition by the NPS.

Existing Conditions

This section provides background information on the five park units at Hopewell Culture and the current operations and management of the park.

Mound City Group Unit

This unit is located north of Chillicothe on the west side of the Scioto River. It is accessed from State Route 104 (S.R. 104), about 1.5 miles north of U.S. 35. The 120-acre site consists of developed visitor facilities, a mowed clearing containing the mounds and earthworks, hardwood forest, riparian vegetation along the river, and agricultural lands. The unit is bounded on the south by the Chillicothe Correctional Institution (CCI), on the west by the Ross Correctional Institution (RCI), on the north by prison-owned land in agricultural production, and on the east by the Scioto River. Nearby and adjacent to the CCI is a Department of Veterans Affairs Medical Center.

Mound City Group serves as the central visitor orientation point for the other units. Facilities include a visitor center, interpretive wayside exhibits (some with audio stations), and a nature trail. Selected items from the many Hopewellian artifacts excavated at Mound City Group are on display in the visitor center's musuem.

Park headquarters is also located at Mound City Group. Most of the administrative offices are in a structure that once served as housing for the park superintendent. A new maintenance building and a resource management building, which houses the park's collections, are also near the administration building. All facilities at Mound City Group are owned and operated by NPS.

The Ohio-Erie Canal, built in the 1830s, ran just 0.25 mile west of Mound City Group. Lock No. 35 from the canal was dissembled in the 1930s, and the stones have been placed along the nature trail. During World War I the Mound City Group site was occupied by a military training center known as Camp Sherman. In the early 1920s after Camp Sherman was razed, the Ohio Historical Society excavated the site and began the reconstruction of the Hopewell earthworks and mounds.

Hopeton Earthworks Unit

This unit is located 1.5 miles east of the Mound City Group unit, on a terrace east of the Scioto River. This site is not directly accessible from the Mound City Group unit; access to Hopeton Earthworks is from Business Route 23/S.R. 159, about two miles north of U.S. 35. The unit containns 375 acres.

The site is fairly flat and open, but there is some elevation gain moving eastward from the river. There is an early growth hardwood forest and a black walnut orchard near an intermittent creek at the southeast corner of the site. The unit is owned and administered by NPS, which has acquired most of the available land within the boundaries. There is no regular visitor use of the area due to a lack of facilities and safety issues associated with a gravel mining operation immediately adjacent to the earthworks.

Most of the land is in agricultural production and hay is mown under an agricultural lease. The gravel mining operation has stripped much of the area west of the principal earthworks and the mining operation will continue until the gravel deposit has been exhausted. Surrounding land uses include the Chesapeake and Ohio Railroad on the eastern boundary, croplands and the Scioto River on the north, west, and southwest, and multifamily housing (apartment complexes) and agriculture on the south. Gravel will be extracted in the future from the lands to the west, northwest, and southwest of Hopeton Earthworks.

Management is primarily aimed at preserving the remaining archeological resources, most of which are beneath the ground surface. Because adjacent land has the potential for discovery of Hopewell settlement sites, the park is working with the gravel company to conduct archeological investigations in the area proposed for gravel extraction.

Hopewell Mound Group Unit

This approximately 310-acre unit is located about five miles west of Mound City Group, on the North Fork of Paint Creek. The Hopewell Mound Group unit is the type site for the Hopewell culture. Archeologists named the site for one of the hisotric landowners, Mordecai Hopewell.

The site is accessed from Sulphur Lick Road, which crosses through the earthworks to the south. There are two abandoned railroad beds south of and parallel to Sulphur Lick Road. Ross County Park District owns much of the right-of-way of the northern line between the Hopewell Mound Group Unit and the towns of Frankfort and Chillicothe and has converted it into a trail. The site slopes gently upward from south to north, and rises abruptly into hills along the northern boundary. It is predominantly in fallow agricultural fields, with hardwood forest covering the hillier northern section and intermittent drainages on the east and west boundaries. The Hopewell

Mound Group unit has the highest plant diversity of the five sites. Hills and vegetation on the north and the hills across the river provide a feeling of enclosure, which is reinforced by trees along the North Fork of Sulphur Lick Creek and along the western boundary.

There is one private residence south of Sulphur Lick Road within park boundaries. Next to this residence, the park has recently acquired three barns. Beyond the boundaries on the north and west sides, the predominant land use is a mixture of hay fields and wooded areas, with a low residential density. New subdivision development will add several hundred residences to this area in the near future. New single-family residential development is currently occurring along Anderson Station Road, east of the site. Except for the one residence, land between Sulphur Lick Road and the North Fork of Paint Creek is vacant.

Hopewell Mound Group currently is not accessible to visitors, except along the trail. Although it has been extensively excavated in the past, the site still offers considerable potential for expanding knowledge about the Hopewell culture and is listed on the National Register of Historic Places.

Seip Earthworks Unit

Seip Earthworks is located about 17 miles southwest of Mound City Group, about two miles east of the town of Bainbridge on U.S. 50. It is 165 acres in size and is surrounded by agricultural fields on the east and west, Paint Creek on the south, and wooded hills further to the north and south. A few houses on large lots are adjacent to the park along U.S. 50. A K-12 public school complex is located just east of the site. The site contains over 120 acres and is open to for public visitation.

There is an Ohio Department of Transportation rest area along U.S. 50, which contains a small picnic area and restrooms. The central third of the unit is owned and managed by the Ohio Historical Society and facilities include an interpretive kiosk, wayside exhibits that interpret workshop foundations, and a reconstructed mound. The site is listed on the National Register of Historic Places. It is an authorized acquisition under the 1992 legislation and much of the lands not currently owned by the Ohio Historical Society have been acquired by the National Park Service. The remainder will be acquired in the future.

High Bank Works Unit

The High Bank Works Unit is located about eight miles south of the Mound City Group Unit, on a terrace above the Scioto River. It is accessed from U.S. 35 near the junction with U.S. 23.

Three different sets of railroad tracks traverse the area, and agricultural lands and three private residences occupy the 167-acre site. Cultivation, erosion, and flooding have reduced many of the surface features, but the walls are relatively intact and portions of the octagon are visible and many subsurface resources remain. This unit offers outstanding potential for research. The area is listed in the National Register of Historic Places and NPS has recently acqired most of the site. One privately owned parcel which contains two residences remains to be acquired.

Vegetation

In 1995 a plant survey of all five units within the park's legislated boundary was completed (Bennett and Course 1996). This represented the first comprehensive inventory of the plants on park lands and provided a complete listing of native and non-native plants, including threatened and endangered plant species. Of the 438 different species collected approximately 65% are native.

The primary consideration for vegetation management practices in the park is the protection of the cultural resources. Native grasses are used as cover on the earthworks whenever possible, but there are situations where protection of the archeological resource necessitates the use of nonnative grasses. Generally the visitor use areas are kept closely cut to allow visitor access and to facilitate viewing of the earthworks. In areas that do not receive regular visitation grass is allowed to grow and is typically cut two or three times a year.

All the units of the park have been logged and farmed during the past 200 years. Farming still occurs on small portions of park lands. In some of the park units, forest regeneration has been allowed to occur for the past 20 to 30 years. As a result, park lands are primarily hay fields, grasslands, or early successional forest, with a mixture of native and non-native vegetation. There is no old growth forest or pristine natural habitat, although there are some older and larger trees at some of the units that have the character of old growth.

Since park lands have been disturbed by logging and farming, most areas are populated with at least some non-native plants. Japanese honeysuckle, multiflora rose, Canada thistle, and Johnson grass are some of the more common non-native species. There are no federally listed threatened or endangered plant species known to grow on any of the park units, although the U.S. Fish and Wildlife (FWS) indicates that one species, running buffalo clover (*Trifolium stoloniferum*), could occur in the area. Lesser ladies tresses (*Spiranthes ovalis* var. *erostellata*) was found at the Mound City Group and is listed as potentially threatened by the state of Ohio. The ovate spike rush (*Eleocharis ovata*), an Ohio state endangered species, was found at the Hopewell Mound Group unit.

Mound City Group Unit

The most complex unit of the park, from a vegetation standpoint, is the Mound City Group unit. There are approximately 30 acres around the visitor center, mounds, and administration building that are maintained as mowed lawn with scattered trees and shrubs. Most of this area is mowed on a regular basis while a smaller section, including most of the earthen wall and areas on both sides of the wall are mowed less regularly and not as short. This is done to reduce maintenance costs and provide a less manicured look to a portion of the earthworks. Although current management of this area does not present an accurate context for the Hopewell culture, it does provide adequate protection to the archeological resource. It also presents the mounds in sharp contrast to the surrounding area, allowing visitors a clear view of the earthworks.

The fields at the north end of the Mound City are cut for hay twice a year under a Memorandum of Understanding with the Ross Correctional Institution. Most of the remaining 45 acres is early growth mixed hardwood forest about 30 years old. This wooded area has been allowed to grow

with only sporadic attempts to control alien vegetation and has grown up to a mixture of native and non-native plants. Japanese honeysuckle (*Lonicera japonica*) is a particularly troublesome invasive alien species in this area. Given enough time, many of the exotic plants may be eliminated by shade and competition from the native hardwood species. The area bordering the Scioto River has more mature trees which gives it some of the characteristics of an old growth hardwood forest.

Trees do occupy an area of the earthwork at the northeast corner, although the trees and brush found in this unit are not considered to be invading the earthworks, and are not being actively managed or controlled. Maintenance mowing of the lawn areas and the earthworks and haying by the Ross correctional facility keeps trees and brushy species in check. Wildland fires have not been recorded. Overall, the desire is to move the area to a mix of native species with a hope of establishing a less "manicured" appearance. Active management in the forested areas is being considered and research will continue in selected areas which may involve small management prescribed fires. As a less manicured areas is developed, the risk of wildland fires increases slightly, but still remains fairly low.

There were no federal listed sensitive species known to be growing on the Mound City Group unit, however, Lesser ladies tresses (*Spiranthes ovalis* var. *erostellata*) was found at Mound City and is listed as potentially threatened by the state of Ohio.

Hopeton Earthworks Unit

The 375 acres of the Hopeton Earthworks unit is located on a terrace east of the Scioto River. The site is level and open, with a gentle rise eastward from the river. About 230 acres are cropland or former cropland grown into fields of mixed native and exotic forbs and grasses. The remainder is hardwood forest or black walnut orchard, and an intermittent creek is located at the southeast corner of the unit. A couple of overgrown fence lines cross-cross the Hopeton Earthworks unit and are gradually being removed. These pose a serious threat of tree falls that could destroy archeological resources and obscure views of the earthworks. Removal of the fence lines and trees is a management goal.

A large active gravel mining operation is located immediately west of the earthwork. There is some potential for woody species to invade the old cropland and eventually the earthworks. Prescribed fires in this area may be used to evaluate the effectiveness of fire in limiting the spread of invasive woody species. As agricultural land are removed from production and allowed to revert to early successional stage grasslands, the potential for wildland fires increases slightly but still remain very small. There is also the potential for evaluating the effectiveness of hazard fuel management using prescribed fires.

Hopewell Mound Group

The 310-acre Hopewell Mound Group occupies the entire width of a broad level plain on top of a 15-foot high second terrace along the North Fork of Paint Creek. The site slopes gently upward from south to north, and rises abruptly onto the third terrace along the northern boundary. Hills

and vegetation on the north and the hills across the river provide a feeling of enclosure, which is reinforced by trees along the creek and along the western boundary.

Heavy forest vegetation both protects the northern edge of the earthwork, and serves a troublesome reservoir for the aggressivly invasive multiflora rose, which dominates the understory. Trees bisect the large rectangular earthwork. The site was almost entirely in alfalfa, but is now in early successional stage. As the early successional species on the old alfalfa fields matures, there is an increased potential for wildland fires, although it remains small.

Seip Earthworks Unit

The Seip Earthworks unit is 165 acres in size, and is surrounded by agricultural fields on the east and west, Paint Creek on the south, and wooded hills further to the north and south. The majority of the site owned by NPS is successional grassland although the area along Paint Creek is dominated by woody species and could serve as a reservoir of invasive woody plants. Portions of the unit owned by the Ohio Historical Society are kept in short grasses, in hay fields, or as cropland. The potential for wildland at this site fires is very small.

High Bank Works

No active plowing or planting is occurring on park-owned lands. Although no agricultural leases remain, approximately 1/3 of the High Bank Works unit is still in alfalfa and 2/3 is early successional grass. Very little woody vegetation exists at the site, although there are numerous weed species present. Prescribed fires may be used to research the effectiveness of fire on establishing desired grass and forb species and how fire affects archeological research using geophysical techniques. As the early successional grass matures, there is a slight increase in the chance for wildland fires, although it still remains very small.

Wildlife

The relatively small parcels of land in each unit, the scattered character of the holdings, and the general agricultural/rural nature of the setting prevents any particular population of wildlife species (except for small mammals and birds) being considered "resident." The wildlife populations present at the park include those species generally found throughout the region.

Wildlife surveys have recently been conducted within the park, with preliminary results showing some common mammals known to occur on parkland: raccoon *(Procyon lotor)*; woodchuck *(Marmota monax);* eastern cottontail *(Sylvilagus floridanus);* beaver *(Castor canadensis);* white-tailed deer *(Odocoileus virginianus);* little brown bat *(Myotis lucifugus);* gray squirrel *(Sciurus carolinensis carolinensis; Sciurus carolinensis pennsylvanicus);* striped skunk *(Mephitis mephitis);* Virginia opossum (*Didelphis virginiana);* Eastern mole (*Scalopus aquaticus);* thirteen-lined ground squirrel (*Spermophilus tridecemlineatus);* and coyote (*Canis latrans).* There are also numerous vole and mouse species, and other small mammals.

There are several reptiles that are common locally and are likely to occur in the Park. These include: Eastern garter snake (*Thamnophis sirtalis sirtalis*); black rat snake *(Elaphe obsoleta obsoleta);* Eastern milk snake *(Lampropeltis triangulum triangulum);* Northern fence lizard *(Sceloporus undulatus hyacinthinus);* five-lined skink (Eumeces fasciatus); Eastern box turtle *(Terrapene carolina carolina);* and Midland painted turtle *(Chrysemys picta marginata*). Common amphibians of the area include: American toad *(Bufo americanus);* bullfrog *(Rana catesbeiana);* green frog *(Rana clamitans melanota);* and Northern leopard frog *(Rana pipiens).*

In addition to the checklist of bird sightings compiled by volunteers and park staff, a formal bird survey and report was completed in October 2000. This provides a fairly accurate list of birds in the area, but it includes little data on nesting or population or trends trends. There is also very little park specific information on invertebrates with the exception of information gathered from monitoring a few pest species. The Park's wildlife population is not believed to be substantially different from similar habitats in surrounding areas. At present, wildlife management in the park consists primarily of monitoring and, if necessary, removing a few pest species.

One particularly destructive mammal to archeological sites at the park is the groundhog. Extensive burrowing by groundhogs in archeological sites can mix soil strata to the point where reconstructing the archeological record is more difficult and in some places the record can be destroyed completely. Although a native species, the control of groundhogs is occasionally necessary to prevent damage to archeological resources in and around the earthworks. Raccoon, have recently become more numerous and sometimes can be aggressive around picnic areas. They often invade trash cans, scattering trash and becoming aggressive. Because of the potential for visitor injuries and rabies, problem raccoons are trapped and removed.

Gypsy moth (*Lymantria dispar*) are beginning to invade the area of the Park. Tree mortality due to gypsy moth infestation could increase the amount of readily burnable fuel. Currently the moth has not moved into the area in large numbers, but pheromone traps indicate they are in the area. State parks nearby conduct some control measures, however monitoring activities are the only activity currently being conducted at the park. The emerald ash borer (*Agrilus planipennis*) is another potential invasive that has not been found in this area, but documented in Central Ohio and further northwest. Working with the US Forest Service, a sample of ash trees have been studied and will be monitored for signs of infestation. In addition, hornets and yellow jackets (Vespidae) occasionally become a problem around administrative and visitor use areas. When they become a safety hazard, control measures are necessary.

Threatened and Endangered Species

According to the FWS (See memo appendix # 1), two Federally-listed threatened or endangered wildlife species may occur in the park based on their habitat range: Indiana bat (*Myotis sodalis*) and bald eagle (*Haliaeetus leucocephalus)*. A third species, the timber rattlesnake *(Crotalus horridus horridus*) is currently in a "pre-listing" mode and the FWS has initiated a Conservation Action Plan. Only the timber rattlesnake represents what might be a year-round local resident, while the bald eagle and Indiana bat may occur seasonally.

None of these species is known to occur on or near any of the park units. Based on a herpetological survey conducted in 2002-2003, habitat for the timber rattlesnake was not found within park boundaries; therefore, they were determined not to occur in the area. Bald eagles have been observed flying over park land; however no nest is located within or near park boundaries. In the case of Indiana bats, potential habitat does exist within park land, therefore the park will exercise care and vigilance when initiating action that has the potential to affect Indiana bats and their habitat. In addition, the mitigation measures recommended in the FWS comments and outlined in the Environmental Consequences section later in this document will be strictly adhered to.

Water Resources

All of the park units are located near rivers or creeks, primarily the Scioto River and Paint Creek, which is a tributary of the Scioto River. The Ohio Environmental Protection Agency (EPA) has actively sampled and surveyed these streams along their entire mainstem and even some of the tributaries which flow into these larger water bodies.

One of the indices the Ohio EPA utilizes in order to determine the water quality and health of streams is the Index of Biotic Integrity (IBI). The IBI is used to measure the conditions of an aquatic community and its surroundings by using fish species as indicators. Typically, the causes of degradation in Ohio include encroachment, hydro-modification, sedimentation, and pollution. The main land use occurring in the Paint Creek basin is agriculture and as a result, cropland erosion and sedimentation are significant causes of degradation in watersheds.

The Scioto River has shown an overall increase in IBI score from the low 30's to low 40's with a possible score of 60 indicating a site closely resembling an undisturbed state. Levels above 40 are categorized as good. Sampling of Paint Creek along the mainstem showed IBI scores in the low 50's, which is considered exceptional. Both streams have shown an increase in IBI scores, reflecting improved water quality. Upstream measures such as erosion and sediment control, decreased use of pesticides on farmland, the widespread use of no-till farming, and increased stream buffer and sediment catchments help to bring about water quality improvement.

The Mound City Group facilities receive water service from the Ross Correctional Institute. The Department of Veterans Affairs Medical Center is served by potable water wells on Mound City Group unit. A single abandoned domestic water well is on the newly acquired Hopewell Mound Group unit, which will be plugged and decommissioned in the future.

Cultural Resources

In the central Ohio Valley, from 200 B.C. to A.D. 500, people built numerous earthworks consisting of earthen embankments and mounds. Some mounds cover the remains of wooden mortuary buildings where people conducted activities related to treatment of the dead. Today we refer to these Native American mound builders as belonging to the Hopewell culture. The term Hopewell describes a broad network of beliefs and practices among different Native American groups over a large portion of eastern North America. Many of these sites were built to a monumental scale, with earthen walls up to 12 feet high outlining geometric figures more than

1,000 feet across. Conical and loaf-shaped earthen mounds up to 30 feet high are often found in association with the geometric earthworks.

Hopewell mound and earthwork sites are well known for their elaborate burial ceremonialism. Hopewell mounds in the Ohio Valley contain exotic goods from distant locations including marine shell from the Gulf of Mexico, obsidian from the Rockies, and mica from the Carolinas. The Hopewell buried their dead with breast plates, falcon effigies, and turtle shell rattles fashioned from copper mined in Michigan's Upper Peninsula. The most striking Hopewell sites are the geometric earthworks in the form of circles, squares, and octagons.

Hopewell Culture owns and manages five Hopewell earthwork sites in the greater Chillicothe area in south-central Ohio. These nationally significant archeological resources including large earthwork and mound complexes that provide an insight into the social, ceremonial, political, and economic life of the Hopewell people. All of the five sites are located on terraces above rivers or creeks, specifically the Scioto River, Paint Creek, and the North Fork of Paint Creek.

The paragraphs below describe the remains of the earthworks at each unit of the park. In addition, a variety of other archeological resources are found at these sites. The sites all exhibit evidence of occupation by Native Americans from initial human occupation to historic times. There are remains in the form of fire pits, trash pits, post hole patterns, ceramic artifacts, lithic remains, and rarely metal objects. There are also historic remains from Euro-American settlement of the area. These remains include building foundations, ceramic fragments, and metal objects.

The park has an ethnographic resources study, and the study does not indicate any current use of the Park by Federally-recognized tribes. The Park does not have a cultural landscape report. Very little information is available upon which to base a description of the cultural landscape during its prehistoric period of significance.

Mound City Group

Visible Hopewell resources at Mound City Group include a 13-acre rectangular earthen enclosure, within which are at least 23 mounds. The height of the earthen walls of the enclosure is about 3 to 4 feet, with gateways on both the east and west sides. All the mounds are conical except for one which is elliptical. The largest mound of the group was described by early explorers as 17.5 feet in height and 90 feet in diameter. There are two additional mounds just outside the enclosure. All the walls and mounds have been reconstructed. They are clearly visible and are accessible to the public to view and walk around. The Mound City Group is on the National Register of Historic Places.

Hopeton Earthworks Unit

Hopewell earthwork remnants on this 292-acre site consist of a square enclosure about 900 feet on a side joined on its north side to a circular enclosure with a diameter of about 1,050 feet. Smaller circular structures also join the square at various points and two linear embankments extend westward toward the river for about 2,400 feet from the northwest corner of the square.

A description from 1846 indicates that the walls were 50 feet wide at the base. At that time the walls enclosing the square were 12 feet high. Continued cultivation since then has reduced the earthworks to less than five feet in height in most places. Most of them are difficult for the untrained person to see. The small circles and parallel walls are no longer visible. The entire unit is a National Historic Landmark and is on the National Register of Historic Places.

Management is primarily aimed at preserving the remaining archeological resources, most of which are beneath the ground surface. Because adjacent land has the potential for discovery of Hopewell settlement sites, the park is working with the gravel company to conduct archeological investigations in the area proposed for gravel extraction.

Hopewell Mound Group Unit

The general form of the Hopewell Mound Group is that of a parallelogram 2,800 feet long on the east and west sides and 1,800 feet long on the north and south. The west wall is curved slightly outward. The south wall follows the edge of a terrace above the creek. Early archeologists estimated that the walls were originally 35 feet wide at the base, and they enclose an area of 111 acres. A smaller square enclosure with sides 850 feet in length is connected to the east side of the parallelogram. Remnants of the east, west, and north walls are visible. Two earthwork features are located within the parallelogram, one circular and one D-shaped. Three of the seven mounds in the D-shaped enclosure are joined together. Their original size is estimated to be 500 feet long, 180 feet wide, and 30 feet high. This is the largest known mound constructed by the Hopewell culture and a remnant of it is visible today.

Although it has been extensively excavated in the past, the site still offers considerable potential for expanding knowledge about the Hopewell culture and is listed on the National Register of Historic Places.

Seip Earthworks Unit

The large earthworks complex at the Seip Earthworks unit contains low embankment walls forming a small circular enclosure, an irregular circular enclosure, and a square enclosure. These three enclosures are all connected and enclose about 121 acres. Within the largest enclosure is a large elliptical mound, three smaller conjoined mounds, several small mounds, and several workshop structures outlines found through excavations. It is estimated that the largest mound was originally 240 feet long, 160 feet wide, and 30 feet high. A reconstructed mound and a portion of reconstructed wall are visible, and a portion of original wall is visible near Dill Road. Although it has been heavily excavated in the past, the site offers considerable research potential.

The central third of the unit is owned and managed by the Ohio Historical Society and is open for visitation via the Seip Mound State Memorial. Facilities include an interpretive kiosk, wayside exhibits that interpret workshop foundations, and a reconstructed mound. The surrounding parcels are privately owned , except for the Paint Valley School District's K-12 public school complex. The site is listed on the National Register of Historic Places.

High Bank Works Unit

At the time the site at the High Bank Works Unit was recorded in 1848, it contained a circular and an octagonal enclosure, each measuring just over 1,000 feet in diameter. On the interior of the octagon were eight small mounds that correspond to the eight intersecting points of the outer walls. Six of the intersecting points form gateways and one to the north forms an entrance into the large circle. The large circular earthwork has one gateway to the east and is opposite a smaller circular enclosure 250 feet in diameter.

Beyond the southernmost point of the octagon there were two more small circular enclosures with a single gateway, each measuring 300 feet in diameter. They were connected to the larger forms by two nearly parallel embankments extending southwest for almost 2,000 feet. Three small conjoined enclosures were located at the far end of the parallel embankments.

Cultivation, erosion, and flooding have reduced many of the surface features, but the walls are relatively intact and portions of the octagon are visible. Many subsurface resources remain. This unit offers outstanding potential for research but is currently not accessible to the public. The area is listed in the National Register of Historic Places.

Air Quality

According to the Ohio Environmental Protection Agency (EPA), Ross County currently meets or exceeds national air quality goals. The park has no air quality monitoring capabilities. The closest Ohio EPA monitoring station is 20 miles north of the park in Circleville, Ohio, where sulfur dioxide ($S0_2$) and nitrogen dioxide ($N0_2$) are monitored. Of the five criteria pollutants, sulfur dioxide ($S0_2$) and nitrogen dioxide ($N0_2$) are the two most prevalent air pollutants in Ross County, largely because of the presence of the Mead paper plant. Air quality is important for the park primarily because of the sensitivity of copper artifacts to sulfur pollutants.

The Mead Corporation paper plant, located approximately five miles south of the park, monitors for sulfur dioxide (SO_2), volatile organic compounds (VOCs), particulate matter < 10 microns (PM10), nitrogen dioxide ($N0_2$), and carbon monoxide (CO) at monitoring stations located between three and six air miles south of the park. In 1993 the Mead paper plant was ranked as the sixteenth highest $S0_2$ emitter in Ohio. In 1993-1994 the Mead Corporation installed new emission control devices at the Chillicothe plant. The devices were installed primarily for odor control, but also reduced the emission of some pollutants. However, due to increased production at the plant there was no significant decrease in the emission of $S0_2$ According to the data provided by Mead Corporation from 1990 through 1994, SO_2 emissions from the plant remained fairly constant:

1990 - 29,355 (tons/yr)
1991 - 28,202
1992 - 27,992
1993 - 30,172
1994 - 28,498

Although the potential exists for elevated levels of $S0_2$ to impact the park's copper artifacts, a 1995 examination of these artifacts by a metal conservator from the Harpers Ferry Center determined that there had been no significant deterioration in the condition of the artifacts over the past ten years.

Park Facilities, Operations, and Visitor Use

Most of the existing park facilities are found at the Mound City Group unit. This is where the visitor center and administrative, resource management, and maintenance offices are located. The visitor center houses the interpretive offices, book sales area, auditorium, and museum containing collections and interpretive displays. The majority of park visitors tour only Mound City Group. Three additional buildings located away form the visitor center house the remainder of park staff.

The Seip Earthworks unit is managed in conjunction with the Ohio Historical Society and the Ohio Department of Transportation. Visitor facilities at this unit include restrooms, interpretive displays, and kiosks. Since this unit is located on US Highway 50 and there are at least some facilities, it is visited on an occasional basis by school groups and incidental visitors. The Hopewell Mound Group unit has an interpretive display and trail, but as yet is not visited regularly. Ranger guided school groups and occasional casual visitors make up most of the public use of this unit. Improved and expanded interpretive media and programs are planned for Hopewell Mound Group and Seip Earthworks, which would enhance the park's ability to provide in-depth interpretation and education. Visitation to these units is expected to increase in the future.

The Hopeton Earthworks and High Bank Works units are not open to the general public and receive only minimal visitor use, usually in the form of special guided school groups and seminars. The Hopeton Earthworks unit is bordered by an operating gravel mine. The Seip Earthworks and High Bank Works units are in rural agricultural settings. These settings probably would not detract from the visitor experiences that are to be offered at these areas, unless development begins in the area.

Health and Safety

Fires can be hazardous, even life-threatening, to employees, visitors, and firefighters. Current Federal fire management policies emphasize that firefighter and public safety is the first priority; all FMPs must reflect this commitment (NIFC 1998).

There are three certified (red-carded) wildland firefighter employees at Hopewell Culture, although no wildland firefighting equipment is maintained at the park. Any wildland fires that occur would be fought by local volunteer firefighters, as would any structural fires. Little, if any, wildland firefighting capability exists in the local community.

There are no camping facilities at any of the park units, which limits the possibility of accidental fire ignition from camp fires. Picnicking is limited to a maintained lawn area at Mound City Group and the parking lot area at Hopewell Mound Group. The Ohio Department of

Transportation (ODOT) maintained rest area at Seip Earthworks unit does have picnicking facilities and barbeque grills. The chance of wildland fires being accidentally ignited by visitors is remote. Wildland fires are more likely to begin on adjacent land or highway rights-of-way and spread to park lands. Much of the surrounding land is tilled agricultural land or hay fields, which tend to either act as a buffer to wildland fires or to contain them.

Except for preparation and cleanup, there is no capability maintained at the park to carryout a prescribed fire or to fight a wildland fire. In the event that a prescribed fire were proposed and a prescribed fire plan developed, the park would rely on experienced NPS fire coordinator and crews being assigned to the park for the preparation and execution of the plan assistance by Ohio Department of Natural Resources, certified volunteer firefighters, and State Forest Personnel.

ENVIRONMENTAL CONSEQUENCES

Impacts on Vegetation

Impacts to vegetation of the alternatives were qualitatively assessed by means of a literature review and consultation with park resource specialists and fire ecologists.

The impact thresholds used for describing the effects on vegetation of implementing the proposed FMP are as follows:

Negligible	No native vegetation would be affected or some individual native plants could be affected as a result of the alternative, but there would be no effect on native species populations. The effects would be short-term, on a small scale, and no species of special concern would be affected.
Minor	The alternative would affect some individual native plants and would affect a relatively minor portion of that species' population. Mitigation to offset adverse effects, including special measures to avoid affecting species of special concern, could be required and would be effective.
Moderate	The alternative would affect some individual native plants and would also affect a sizeable segment of the species' population in the long-term and over a relatively large area. Mitigation to offset adverse effects could be extensive, it would likely be successful.
Major	The alternative would have a considerable long-term effect on native plant populations, including species of special concern, and affect a relatively large area in and out of the park. Mitigation measures to offset the adverse effects would be required, extensive, and success of the mitigation.
Impairment	The impacts to the Park's vegetation resources are affected to the extent that the: (1) opportunities for using the Park resources or enjoying the Hopewell Culture are significantly diminished, or the vegetation resources are affected to the point of permanent or near permanent variance with the

specific purposes identified in the establishing legislation or proclamation of the Park;
(2) key to the natural or cultural integrity of the Park; or
(3) identified as a goal in the Park's general management plan or other relevant National Park Service planning documents.

Duration Short-term: Recovery or condition improvement in less than 5 years.
Long-term: Takes more than 5 years to recover or improve.

Alternative A – No Action

Under Alternative A, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. Vegetation and hazard fuel management would continue to be accomplished by mowing, hand cutting, stump treatments, and chemical spraying. Prescribed fires would not be allowed. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Vegetation management would consist of mowing grass on the earthworks, cutting and stump treating trees and shrubs, and chemical pesticide applications to control invasive shrubs, grasses, and forbs. All wildland fires would be immediately extinguished.

The primary consideration for vegetation management practices in the Park is the protection of the archeological resource. Native grasses would be used as cover on the earthworks whenever possible. The protection of the archeological resource overrides the necessity for using native grasses. Generally, the visitor use areas would continue to be kept cut to allow visitor access and to facilitate viewing of the earthworks. In areas that do not receive regular visitation grass will be allowed to grow and mowed on a rotating schedule of once every 3 to 4 years.

Grass seeding with desirable but not necessarily native grasses would continue. Seedbed preparation may be necessary prior to grass seeding and may include chemical herbicide applications, mowing, and scarifying soils. The use of chemical treatments would also be used to limit the spread of invasive weed species and would include spot treatments and broadcast treatments. Cutting and cut-stump chemical treatments would be used to limit the spread of woody species onto the earthwork areas.

The establishment and maintenance of grass on the earthworks would continue to be very labor intensive. Mowing areas and cutting woody species, even when done carefully, have the potential to disturb soils by tire rutting and by the mechanical impact of mowing machinery. Both chemical and labor intensive activities will continue to be expensive, and require additional and repeated treatments until desired vegetation is established. Efforts will continue in the Park to identify and guard against the inadvertent damage to state listed species: lesser ladies tresses (*Spiranthes ovalis erostellata*) and ovate spikerush (*Eleocharis ovata*).

The long-term effect on the vegetation of the Park using this alternative is a gradual establishment of desirable grassy vegetation and the elimination of all woody vegetation on all

earthwork areas of the Park. Maintenance activities following desirable grass establishment will continue to require labor intensive methods.

All wildland fires would be extinguished immediately. Minimum Impact Tactics would be utilized on all wildland fires. Wetlines and existing natural and manmade fire barriers would be utilized wherever possible. Cut firelines would be established at the minimum depth and never on the earthworks. Mowed areas on and around earthworks may help check the spread of wildland fires, assisted by wetlines.

This alternative would affect some individual native plants and would affect a relatively minor portion of that species' population. This is because one of the major goals of this and all alternatives is the reduction of woody species on the earthworks of the Park, including native species. In addition, the establishment of non-native grass species at the expense of native species may be desirable, in some areas, to protect the earthworks and archeological resources. The effects of this alternative includes vegetation maintenance activities designed to establish grass cover on and remove woody vegetation from the Park earthworks and to maintain the earthworks in this condition into the future.

The effects on vegetation resources at Hopewell Culture of adopting this alternative are expected to be minor and long term. No impairment of Park resources is expected to occur as a result of adopting this alternative.

Alternative B – Limited Prescribed fires (Preferred Alternative – Environmentally Preferred Alternative)

Under Alternative B, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. The majority of the vegetation management and hazard fuel management would continue to be accomplished by mowing, hand cutting, cut-stump herbicide treatments, and chemical herbicide spraying. Prescribed fires would be allowed on a very limited and restricted basis, being allowed only to evaluate the effects of fires on archeological resources and on data collection. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

The primary consideration for vegetation management practices in the Park would continue to be the protection of the archeological resource. Native grasses would be used as cover on the earthworks whenever possible, but non-native species could also be used if judged desirable. The protection of the archeological resource overrides the necessity for using native grasses. Generally, vegetation in the visitor use areas would continue to be kept cut short to allow visitor access and to facilitate viewing of the earthworks. In areas that do not receive regular visitation grass will be allowed to grow and mowed on a rotating schedule of once every 3 to 4 years.

Grass seeding with desirable but not necessarily native grasses would continue. Seedbed preparation may be necessary prior to grass seeding and may include chemical herbicide applications, mowing, and scarifying soils. Prescribed fires may be used on an experimental basis for seedbed preparation and to judge the effects of fire on archeological resources and data collection. Only if prescribed fires were judged to be safe for archeological resources and data

collection, they may be more widely used on a broader basis for seedbed preparation, hazard fuels management, and invasive species control. Efforts will continue in the Park to identify and guard against the inadvertent damage to state listed species: lesser ladies tresses (*Spiranthes ovalis erostellata*) and ovate spikerush (*Eleocharis ovata*).

Preparations for prescribed fires would always include the review and advice of the Park archeologist in the planning and execution stages. The use of established manmade and natural fire barriers is always desirable to the establishment of new firelines. Mown areas, wetlines, and fire retardants would be used instead of cut firelines.

Should a wildland fire start, it would be extinguished immediately. Minimum Impact Tactics would be utilized on all wildland fires. Wetlines and existing natural and manmade fire barriers would be utilized wherever possible. Cut firelines would be established at the minimum depth and never on the earthworks. Mowed areas on and around earthworks may help check the spread of wildland fires, assisted by wetlines.

Two woody invasive species that seem to be troublesome at the Park are shrub honeysuckle and multiflora rose. These two species are known to be resistant to fire and will not be effectively controlled solely by prescribed fires. The continued labor intensive work of cutting and cut-stump treatments on at least these species will continue under this alternative.

The use of chemical treatments would continue to be used to limit the spread of invasive weed species and may include spot and broadcast treatments. Cutting and cut-stump chemical treatments would continue to be used to limit the spread of woody species onto the earthwork areas. Prescribed fires may be used on an experimental basis to evaluate the effects of fire for controlling woody species on and around the earthworks. If prescribed fires were judged to be safe for archeological resources and data collection following its limited experimental use, prescribed fires may be more widely used for controlling woody species at the Park.

The establishment and maintenance of grass on the earthworks would continue to be very labor intensive. Even if prescribed fires are found to be safe and effective, mowing and cutting of woody species and chemical herbicide treatments will likely continue as maintenance projects. Even when done carefully, mowing and hay cutting have the potential to disturb soils by tire rutting and by the mechanical impact of mowing and haying machinery. Both chemical and labor intensive activities will continue to be expensive and require additional and repeated treatments until desired vegetation is established.

The long-term effect on the vegetation of the Park using this alternative is a gradual establishment of desirable grassy vegetation and the elimination of all woody vegetation on all earthwork areas of the Park. Maintenance activities following desirable grass establishment will continue to require labor intensive methods, but prescribed fires in the future, if found safe to the resources and data collection, may have the potential to reduce the cost of chemical herbicides and mechanical hazard fuel reduction activities, and help establish desirable native vegetation through a natural process.

This alternative would affect some individual native plants and would affect a relatively minor portion of that species' population. This is because one of the major goals of this and all alternatives is the reduction of woody species on the earthworks of the Park, including native species. In addition, the establishment of non-native grass species at the expense of native species may be desirable, in some areas, to protect the earthworks and archeological resources. This alternative includes vegetation maintenance activities designed to establish grass cover on and remove woody vegetation from the Park earthworks and to maintain the earthworks in this condition into the future.

The effects on vegetation resources at Hopewell Culture of adopting this alternative are expected to be minor and long term. No impairment of Park resources is expected to occur as a result of adopting this alternative.

Impacts on Wildlife

Impacts to wildlife of the alternatives were qualitatively assessed by means of a literature review of the effects of fire on wildlife habitat, consultation with biologists, and professional judgment.

Because of the widely dispersed nature of the Hopewell Culture units, an action or event at one unit is not likely to affect the other four units. The Park units vary in size from 375 acres at Hopeton Earthworks to 120 acres at Mound City Group. Although development is moving into the area and numerous private homes and housing developments dot the surrounding landscape, the area adjacent to most of the Park's units is still very rural in character.

None of the units could be considered to be an "island" of habitat surrounded by an urban landscape, as is seen in many other National Park Units in the Midwest. In general, each of the units is simply a part of the expansive rural landscape that includes wildlife habitat for the numerous species that occupy the larger region. The conversion of cropland or hay fields into grasslands following the recent acquisition of several of the units may have increased the total habitat available to several wildlife species, but not significantly, when placed in the context of the larger rural wildlife setting.

The impact thresholds used for describing the effects on wildlife of implementing the proposed FMP are as follows:

Negligible	Wildlife would not be affected or the effects would be at or below the level of detection, would be short-term, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the wildlife species' population.
Minor	Effects to wildlife would be detectable, although the effects would be localized and would be small and of little consequence to the species' population. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Effects to wildlife would be readily detectable, long-term, and localized, with consequences at the population level. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.

Major Effects to wildlife would be obvious, long-term, and would have substantial consequences to wildlife populations in the region. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

Impairment The impacts to the Park's wildlife resources are affected to the extent that the:
(1) opportunities for using the Park resources or enjoying the Hopewell Culture are significantly diminished, or the wildlife resources are affected to the point of permanent or near permanent variance with the specific purposes identified in the establishing legislation or proclamation of the Park;
(2) key to the natural or cultural integrity of the Park; or
(3) identified as a goal in the Park's general management plan or other relevant National Park Service planning documents.

Duration Short-term - Recovers in less than 3 years.
Long-term - Takes more than 3 years to recover.

Alternative A – No Action

Under Alternative A, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. Vegetation and hazard fuel management would continue to be accomplished by mowing , hand cutting, stump treatments, and chemical spraying. Prescribed fires would not be allowed. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Mowing the earthwork areas would continue under this alternative. Mowing grass short has sometimes been shown to affect species populations in various ways. Some mouse and vole species, several snake species, and many grassland birds are sometimes excluded from mown areas because they prefer tall grass. Other rodent species like the thirteen-lined ground squirrel seem to be attracted to mown areas, which may not be desired at Hopewell Culture. White tailed deer on the other hand are attracted to tall grass areas for bedding areas, but are also seen browsing on mown hayfields selecting the newly sprouted vegetation exposed by the short grass. Some ground nesting birds use tall grass for nesting sites and others use short mown areas for hunting rodents. All in all, although there will be habitat modification as a result of mowing, the overall effect on wildlife habitat and species on the larger landscape as a result of mowing the earthworks is insignificant.

The use of herbicide to control exotic weeds and for cut-stump treatments would continue under this alternative. Generally herbicide use at the Park is limited to small localized infestation areas. This type of herbicide use would likely have no effect on wildlife species or habitat. If herbicides were used to prepare large areas for seeding there could be temporary loss of habitat as the vegetation dies and seedbed prepared. However, habitat would be quickly restored as the new seed grew. Wildlife population can even occasionally become a nuisance as they are attracted to newly vegetated areas by the new and tender sprouting plants.

Wildland fires have the potential to cause direct mortality of wildlife, especially small and less mobile species. Some species, such as deer, coyotes, and birds, simply escape the oncoming flames. Nests with eggs or fledglings located on or near the ground can be destroyed. Snakes, toads, and insects may escape but are often caught in the advancing maelstrom near the ground.

This alternative could affect some wildlife individual but would affect only a small portion of any species' population. Habitat in some areas may be permanently altered, since one of the goals of the alternative is to eliminate woody vegetation from the earthwork portion of the Park. The exchange of this woody vegetation with grass would of course also exchange habitat types and thus exchange wildlife species as well. The overall effects on vegetation resources and thus habitat are expected to be minor and long term. No impairment of Park resources is expected to occur as a result of adopting this alternative.

Alternative B – Limited Prescribed fires (Preferred Alternative – Environmentally Preferred Alternative)

Under Alternative B, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. The majority of the vegetation management and hazard fuel management would continue to be accomplished by mowing, hand cutting, cut-stump herbicide treatments, and chemical herbicide spraying. Prescribed fires would be allowed on a very limited restricted basis to evaluate the effects of fires on archeological resources and on data collection. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Mowing the earthwork areas would also continue under this alternative. Mowing grass short has sometimes been shown to affect species populations in various ways. Some mouse and vole species, several snake species, and many grassland birds are sometimes excluded from mown areas because they prefer tall grass. Other rodent species like the thirteen-lined ground squirrel seem to be attracted to mown areas, which may not be desired at Hopewell Culture. White tailed deer on the other hand are attracted to tall grass areas for bedding areas, but are also seen browsing on mown hayfields selecting the newly sprouted vegetation exposed by the short grass. Some ground nesting birds use tall grass for nesting sites and others use short mown areas for hunting rodents. All in all, although there will be habitat modification as a result of mowing, the overall effect on wildlife habitat and species on the larger landscape as a result of mowing the earthworks is insignificant.

The use of herbicide to control exotic weeds and for cut-stump treatments would also continue under this alternative. Generally herbicide use at the Park is limited to small localized infestation areas. This type of herbicide use would likely have no effect on wildlife species or habitat. If herbicides were used to prepare large areas for seeding there could be temporary loss of habitat as the vegetation dies and seedbed prepared. However, habitat would be quickly restored as the new seed grows. Under these conditions, wildlife population can even become a nuisance as they are attracted to newly vegetated areas by the new and tender sprouting plants.

Wildland fires have the potential to cause direct mortality of wildlife, especially small and less mobile species. Some species, such as deer, coyotes, and birds, simply escape the oncoming

flames. Nests with eggs or fledglings located on or near the ground can be destroyed. Snakes, toads, and insects may escape but are often caught in the advancing maelstrom near the ground. Some arboreal species, especially bats and large birds, may lose habitat by the destruction of trees. Adult birds and bats will generally fly away from the fire, although any young may be lost. Any habitat destruction is likely to be incidental and not significant. No wildlife species populations are likely to be adversely affected.

Prescribed fires on a limited basis are allowed under this alternative. Small experimental fires in selected locations are allowed and will be used primarily to evaluate their effect on cultural resources and on data collection techniques.

Prescribed fire at Hopewell Culture would be accompanied by vigorous on the ground preparations. Mowing fire lanes and buffer strips to be used as fire lines, on-site surveys of archeological resources and plant and wildlife species of special concern, and other resources will occur in the days preceeding a burn. Resource and fire specialists will make on-site visits in the days before a prescribed fire and the many firefighters assisting with the prescribed fire will also visit the site. On the day of the prescribed fire, crews and observers will be on-site preparing the area by establishing wetlines, setting up equipment, and coordination activities with personnel from other jurisdictions. This kind of prolonged human activity in the immediate advance of a prescribed fire is disturbing to most wildlife and, if possible, they will vacate the areas prior to a prescribed fire.

Some individual animals may not escape. Nests with eggs or fledglings located on or near the ground can be destroyed, although this is unlikely because most prescribed fires will usually be set prior to or following the nesting period. Snakes, toads, and insects may escape but are often caught in the advancing maelstrom near the ground. Some arboreal species, especially bats and large birds, may lose habitat by the destruction of trees. Adult birds and bats will generally fly away from the fire, although any young may be lost.

Following a prescribed fire, vegetation generally re-grows quickly. Depending upon the weather conditions, grass and forbs may be evident in just a day or so and can be completely established within weeks or months. Prairie-like habitat may be established very quickly.

This alternative could affect some wildlife individuals but would only affect a very small portion of any species' population. Habitats in some areas may permanently be altered, since one of the goals of the alternative is to eliminate woody and brushy vegetation from the earthwork portion of the Park units. The exchange of this woody vegetation with grass would of course also exchange habitat types and thus exchange wildlife species as well. The overall effects on habitat as well as wildlife species are expected to minor and long term. No impairment of Park resources is expected to occur as a result of adopting this alternative.

Impacts on Threatened and Endangered Species

Impacts to threatened and endangered species as a result of adopting the alternatives were qualitatively assessed by means of a literature review of the effects of fire on these species, consultation with biologists and agencies, and professional judgment.

Two Federally threatened or endangered wildlife species may occur in the Park based on their habitat range: Indiana bat (*Myotis sodalis*) and bald eagle (*Haliaeetus leucocephalus)*. A third species, the timber rattlesnake *(Crotalus horridus horridus*), is currently in a "pre-listing" mode and the FWS has initiated a Conservation Action Plan. Only the timber rattlesnake represents what might be a year-round local resident. However, the FWS states that "…In Ohio, the timber rattlesnake is restricted to the un-glaciated Allegheny Plateau…" According to the Ohio Department of Natural Resources, all of Hopewell Culture lies outside of the un-glaciated region of Ohio. It is therefore very unlikely that the timber rattle snake is present within the Park units. The State of Ohio Department of Natural Resources has advised the Park that there are no Bald Eagle nesting sites within 0.5 mile of any Park lands.

The impact thresholds used for describing the effects on Special Status Species of implementing the proposed FMP are as follows:

Negligible — An action that would not affect any individuals of a sensitive species or their habitat within Hopewell Culture. Section 7 conclusion is "no effect."

Minor — An action that would affect a few individuals of sensitive species or have very localized impacts upon their habitat within Hopewell Culture. The change would require considerable scientific effort to measure and have barely perceptible consequences to the species or habitat function. Section 7 conclusion is "no effect" or "not likely to effect."

Moderate — An action that would cause measurable effects on:

(1) a relatively moderate number of individuals within a sensitive species population,

(2) the existing dynamics between multiple species (e.g., predator-prey, herbivore-forage, vegetation structure-wildlife breeding habitat), or

(3) a relatively large habitat area or important habitat attributes within Hopewell Culture.

A sensitive species population or habitat might deviate from normal levels under existing conditions, but would remain indefinitely viable within the Park. Section 7 conclusion is "not likely to adversely affect."

Major — An action that would have drastic and permanent consequences for a sensitive species population, dynamics between multiple species, or almost all available critical or unique habitat area within Hopewell Culture. A sensitive species population or its habitat would be permanently altered from normal levels under existing conditions and the species would be at risk of extirpation from the Park. Section 7 conclusion is "likely to adversely affect" or "likely to jeopardize species or habitat."

Impairment — The impacts to the Park's sensitive species resources are affected to the extent that the:

(1) opportunities for using the Park resources or enjoying the Hopewell Culture are significantly diminished, or threatened or endangered species are affected to the point of permanent or near permanent variance with the

specific purposes identified in the establishing legislation or proclamation of the Park;
(2) key to the natural or cultural integrity of the Park; or
(3) identified as a goal in the Park's general management plan or other relevant National Park Service planning documents.

Duration Short-term - Recovers in less than 2 years.
Long-term - Takes more than 2 years to recover.

Alternative A – No Action

Under Alternative A, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. Vegetation and hazard fuel management would continue to be accomplished by mowing, hand cutting, stump treatments, and chemical spraying. Prescribed fires would not be allowed. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Mowing and haying will continue under this alternative and does have the potential to harm snakes, small mammals, and fledgling birds caught in the path of mowers. The potential for harming endangered species or their habitat as a result of this activity is extremely limited. The prelisted species, timber rattlesnake could occur in the Park according to the FWS, but the Park lies outside of their identified range of the un-glaciated Allegheny Plateau in Ohio. It is therefore very unlikely that this species could be harmed by these activities.

Herbicide use will be continued as a result of adopting this alternative. It is expected that the use of herbicides will have no effect on threatened and endangered species.

Cutting brush and woody vegetation will continue under this alternative. This includes cutting and removing trees which could be used as roosting sites for bald eagles, especially those trees along the rivers and streams. However, the majority of the tree removal activities would take place on or near the earthworks, and most of these trees are far removed from water, fairly young, and generally unsuited to roosting by eagles. Cutting trees on and near the earthworks is expected to have no effect on eagles.

Dead or live trees with peeling or exfoliating bark or with split trunk or cavities could be used as maternity roosts for the Indiana bat. This is especially true along stream corridors, riparian areas, and upland woodlots. If trees with these characteristics are found and need to be removed, the Park will conduct this activity between September 15 and April 15 to avoid potential impact as stated by the guidelines from the FWS Ecological Services Field Office in Reynoldsburg, Ohio. Alternatively should trees need to be removed during the active season for Indiana bats, a bat survey will be conducted to determine if they are present and using the trees. The survey will be coordinated with the FWS endangered species coordinator.

Federally threatened and endangered species have never been found at Hopewell Culture and the activities proposed under this alternative have a very small possibility of affecting them if they

are present. The overall impact of adopting this alternative is negligible and short term. No impairment of Park resources will occur as a result of adopting this alternative.

Alternative B – Limited Prescribed fires (Preferred Alternative – Environmentally Preferred Alternative)

Under Alternative B, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. The majority of the vegetation management and hazard fuel management would continue to be accomplished by mowing, hand cutting, cut-stump herbicide treatments, and chemical herbicide spraying. Prescribed fires would be allowed on a very limited and restricted basis, being allowed only to evaluate their effects on archeological resources and on data collection. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Mowing and haying will continue under this alternative and does have the potential to harm snakes, small mammals, and fledgling birds caught in the path of mowers. The potential for harming endangered species or their habitat as a result of this activity is extremely limited. The Federally prelisted species, timber rattlesnake could occur in the Park according to the FWS, but the Park lies outside of their identified range of the un-glaciated Allegheny Plateau in Ohio. It is therefore very unlikely that this species could be harmed by these activities.

Herbicide use will be continued as a result of adopting this alternative. It is expected that the use of herbicides will have no effect on threatened and endangered species.

Cutting brush and woody vegetation will continue under this alternative. This includes cutting and removing trees which could be used as roosting sites for bald eagles, especially those trees along the rivers and streams. However, the majority of the tree removal activities would take place on or near the earthworks, and most of these trees are far removed from water, fairly young, and generally unsuited to roosting by eagles. Cutting trees on and near the earthworks is expected to have no effect on eagles.

Dead or live trees with peeling or exfoliating bark or with split trunk or cavities could be used as maternity roosts for the Indiana bat. This is especially true along stream corridors, riparian areas, and upland woodlots. If trees with these characteristics are found and need to be removed, the Park will conduct this activity between September 15 and April 15 to avoid potential impact as stated by the guidelines from the FWS Ecological Services Field Office in Reynoldsburg, Ohio. Alternatively should trees need to be removed during the active season for Indiana bats, a bat survey will be conducted to determine if they are present and using the trees. The survey will be coordinated with the FWS endangered species coordinator.

Prescribed fire will be allowed on an experimental basis under this alternative to evaluate the effects of fire on archeological resources and on data collection.

There are no known bald eagle nesting sites within 0.5 mile of Park lands. During a prescribed fire, any bald eagle nearby may simply fly away and return after the human activity has ceased. Bald eagles are not expected to be affected by the use of prescribed fire. Indiana bats may use

trees with cavities or exfoliated bark as maternity roosting sites, but these kinds of trees are not the target of prescribed fires nor are they expected to be affected by them. Indiana bats or their roosts are not expected to be affected by prescribed fires.

Prescribed fires do have the potential to kill small mammals, nesting and fledgling birds, toads, insects, and snakes. As stated previously, timber rattlesnake could occur in the Park according to the FWS, but the Park lies outside of their identified range of the un-glaciated Allegheny Plateau in Ohio. Timber rattlesnakes have never been seen on Park lands. It is very unlikely that timber rattlesnake might be harmed by these activities.

Federally threatened and endangered species have never been found at Hopewell Culture and the activities proposed under this alternative have a very small possibility of affecting them if they are present. The overall impact of adopting this alternative is negligible and short term. No impairment of Park resources will occur as a result of adopting this alternative.

Impacts on Water Resources

The study team qualitatively assessed impacts to water resources by means of reviewing literature and applying professional judgment and experience with water resources (quality and quantity) to the particular hydrologic conditions of Hopewell Culture.

Four of the five units of the park boarder streams. Mound City and High Bank Works are located on the Scioto River, a major tributary of the Ohio River. Seip Earthworks are located on the Paint Creek a tributary of the Scioto. Hopewell Mound Group is located on the North Fork of Paint Creek. The Park boundaries are located at the high water mark of these streams and are therefore not within the park.

None of the streams have special designation. However, Paint Creek is one the more outstanding aquatic habitat in Ohio (personal commutations with Ohio Environmental Protection Agency). All of the streams are impacted by run off from farms, urban and suburban areas. The most likely impact is soil erosion from fires that kill the established grasses.

The impact thresholds used for describing the effects on water resources of implementing the proposed FMP are as follows:

Negligible	Water quality would not be affected, or changes would be either non-detectable or if detected, would have effects that would be considered slight, local, and short-term.
Minor	Changes in water quality or hydrology would be measurable, although the changes would be small, likely short-term, and the effects would be localized. No mitigation measure associated with water quality or hydrology would be necessary.
Moderate	Changes in water quality or hydrology would be measurable and long-term but would be relatively local. Mitigation measures associated with water quality or hydrology would be necessary and the measures would likely succeed.

Major — Changes in water quality or hydrology would be readily measurable, would have substantial consequences, and would be noticed on a regional scale. Mitigation measures would be necessary and their success would not be guaranteed.

Impairment — A major adverse impact to the water quality that would directly affect a resource whose conservation is

(1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Hopewell Culture.
(2) key to the natural or cultural integrity of the Park; or
(3) identified as a goal in the general management plan or other relevant National Park Service planning documents.

Duration — Short-term - Following treatment, recovery will take less than 6 months.
Long-term - Following treatment, recovery will take longer than 6 months.

Alternative A – No Action

Under Alternative A, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. Vegetation and hazard fuel management would continue to be accomplished by mowing, hand cutting, stump treatments, and chemical spraying. Prescribed fires would not be allowed. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Mowing and haying in limited areas will continue under this alternative. Mowing and haying are excellent methods of removing hazard fuels and still preventing water erosion. Even if all of the cut material is removed as hay, enough rooted vegetation usually remains to limit or prevent normal rain events from moving significant amounts of mineral and suspended solids into drainages. However, if mowing is very frequent, root vigor may be reduced thus limiting the ability of the roots to “hold” soil in place during very heavy rain events.

This alternative includes the use of cutting and pesticides for removing invasive woody plants. If pesticides are used near the waterways, there is potential for increased drift contamination of the waterways or leaching to groundwater. Because of this, this alternative does pose a very small hazard for increased water quality degradation. All precautions for pesticide applications under the NPS Integrated Pest Management program will be followed.

The majority of vegetation management at the Park takes place on or near the earthworks. These structures are relatively distant from the area waterways. Because of this, and the limited hazard for water contamination using any of the vegetation management activities under this alternative, the impact to water resources and water quality are expected to be negligible and short term. No impairment to Park resources will occur as a result of the adoption of this alternative.

Alternative B – Limited Prescribed fires (Preferred Alternative – Environmentally Preferred Alternative)

Under Alternative B, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. The majority of the vegetation management and hazard fuel management would continue to be accomplished by mowing, hand cutting, cut-stump herbicide treatments, and chemical herbicide spraying. Prescribed fires would be allowed on a very limited and restricted basis, being allowed only to evaluate their effects on archeological resources and on data collection. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Mowing and haying in limited areas will continue under this alternative. Mowing and haying are excellent methods of removing hazard fuels and still preventing water erosion. Even if all of the cut material is removed as hay, enough rooted vegetation usually remains to limit or prevent normal rain events from moving significant amounts of mineral and suspended solids into drainages. However, if mowing is very frequent, root vigor may be reduced thus limiting the ability of the roots to "hold" soil in place during very heavy rain events.

This alternative includes the use of cutting and pesticides for removing invasive woody plants. If pesticides are used near the waterways, there is potential for increased drift contamination of the waterways or leaching to groundwater. Because of this, this alternative does pose a very small hazard for increased water quality degradation. All precautions for pesticide applications under the NPS Integrated Pest Management program will be followed.

The greatest potential for the degradation of water quality would be associated with runoff from rains following a fire. However, the topography of the majority of the area is fairly flat. Presently, much of the area adjacent or near the Scioto River, Paint Creek, or North Fork of Paint Creek is dominated by woody vegetation and trees. A fire in these areas may increase the opportunity for rain event erosion to transport soil and debris directly into the waterways. This would have a minor negative effect on the water quality of the waterways by introducing additional soil and debris into the river immediately following a fire. However as soon as the desired grassy vegetation begins to grow again (one to six weeks depending upon environmental factors such as snowfall, rainfall, sunshine, air temperature), the potential for rain event erosion is greatly reduced.

As grassy vegetation reestablishes itself on the stream banks following the use of prescribed fires, the potential for erosion becomes less likely. This is because the resulting grassy vegetation should have a persistent root mat that is normally unaffected by fire. This root mat holds soil and debris in place, even during rain events. In addition, perennial grasses re-sprout and grow quickly, thereby minimizing the time window that erosion can occur. Over several possible cycles of prescribed fire use, as the native vegetation reestablishes itself, this alternative has the potential to decrease overall erosion within the Park units. It is unclear if this improvement in erosion control will have any effect on the overall water quality of any of the waterways near the Park units.

The majority of vegetation management at the Park takes place on or near the earthworks. These structures are relatively distant from the area waterways. Because of this, and the limited hazard for water contamination using any of the vegetation management activities under this alternative, the impact to water resources and water quality are expected to be negligible and short term. No impairment to Park resources will occur as a result of the adoption of this alternative.

Impacts on Cultural Resources

Impacts to cultural resources were assessed qualitatively by examining literature on the impact of fires and fire suppression on cultural resources and by discussions with archeologists and cultural resource authorities.

The impact thresholds used for describing the effects on Archeological Resources of implementing the proposed FMP are as follows:

Negligible	Impact is at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of effect for §106 would be no adverse effect.
Minor	*Adverse:* disturbance of a site(s) results in little, if any, loss of integrity. The determination of effect for §106 would be no adverse effect. *Beneficial:* maintenance and preservation of a site(s). The determination of effect for §106 would be no adverse effect.
Moderate	*Adverse*: disturbance of a site(s) results in loss of integrity. The determination of effect for §106 would be adverse effect. A MOA is executed among the NPS and SHPO/THPO and, if necessary, ACHP per 36 CFR 800.6(b). Mitigation measures in MOA minimize or mitigate adverse impacts and reduce the intensity of impact from major to moderate. *Beneficial:* stabilization of a site(s). The determination of effect §106 would be no adverse effect.
Major	*Adverse:* disturbance of a site(s) results in loss of integrity. The determination of effect for §106 would be adverse effect. Measures to minimize or mitigate adverse impacts cannot be agreed upon and the NPS and applicable SHPO/THPO/ACHP are unable to negotiate and execute a MOA in accordance with 36 CFR 800.6(b). *Beneficial:* active intervention to preserve a site(s). The determination of effect for §106 would be no adverse effect.
Impairment	The impacts to the Park's cultural resources are affected to the extent that the: (1) opportunities for using the Park resources or enjoying the Hopewell Culture are significantly diminished, or the cultural resources are affected to the point of permanent or near permanent variance with the specific purposes identified in the establishing legislation or proclamation of the Park; (2) key to the natural or cultural integrity of the Park; or (3) identified as a goal in the Park's general management plan or other relevant National Park Service planning documents.

Duration — Short Term: Return to desired condition or improvement to desired condition in one year or less.
Long Term: Return to desired condition or improvement to desired condition in over one year but less than 10 years.
Permanent: The effects of the action last longer than 10 years, are permanent, or nearly permanent.

Alternative A – No Action

Under Alternative A, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. Vegetation and hazard fuel management would continue to be accomplished by mowing, hand cutting, stump treatments, and chemical spraying. All wildland fires would be immediately extinguished. Prescribed fires, including those designed to evaluate the effects of fire on archeological resources, or its effect on resource data collection, would not be allowed. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Proper mowing and haying practices would have minimal impacts to cultural resources. Adjustment of the mowing schedule and blade heights avoids the creation of bare spots, loss of vegetation, cutting into the earthworks, compaction from tractors, and rutting from farm equipment.

The selective removal of trees has negligible impacts to cultural resources. Hazardous trees would continue to be removed to prevent tree throws that would uproot the tree and a sizeable portion of soil. Trees would be cut at ground level and stumps treated with herbicide. Heavy equipment would be kept off earthworks or other known archeological sites to avoid site compaction.

Herbicide use does not have an effect on archeological resources but may hamper archeological investigations that use certain geophysical techniques. In particular, certain agricultural chemicals to control plants may affect conductivity readings (Clay 2001). It is unknown when conductivity readings return to normal but effects should be limited to the short term. Because park staff relies heavily on geophysical surveys to locate archeological resources, it is recommended that large-scale application of herbicides be kept to a minimum in areas without sufficient archeological surveys.

As noted above, all wildland fires would be suppressed and no prescribed fires would be used. Depending on the severity of the fire, wildland fires can be extremely damaging to cultural resources. As such, importance must be placed on reducing hazard fuels and suppressing wildland fires. Hazard fuels management would continue to be accomplished by hand cutting and mowing. Impacts to cultural resources from wildfires would be minimized by immediately suppressing them. Wildland fires would use Minimum Impact Suppression Tactics to minimize the long-term effects of the suppression action. Suppression activities would be planned in conjunction with an archeologist to reduce or eliminate any impacts to earthworks or other archeological resources.

Much of the land at Hopewell Culture contains the remnants of earthwork sites. Actions pertaining to vegetation management activities have the potential to effect archeological resources. However, current management practices, such as mowing, haying, cutting trees, and using herbicides, pose little to no threat to cultural resources if proper care is exercised. Wildland fire can damage cultural resources and must be immediately suppressed. Suppression activities can cause additional damage; however, the impacts from suppression activities would be mitigated to the extent possible in order to preserve cultural resources. Thus, under this alternative the overall impact to cultural resources would be negligible to minor and short term. No impairment of Park resources will occur as a result of adopting this alternative.

Alternative B – Limited Prescribed fires (Preferred Alternative – Environmentally Preferred Alternative)

Under Alternative B, the Park would adopt a new FMP that encompasses all of the requirements and provisions outlined in DO-18. The majority of the vegetation management and hazard fuel management would continue to be accomplished by mowing, hand cutting, cut-stump herbicide treatments, and chemical herbicide spraying. All wildland fires would be immediately extinguished. Prescribed fires would be allowed on a very limited and restricted basis, only for evaluating effects of fires on archeological resources and the collection of data using geophysical techniques. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Proper mowing and haying practices would have minimal impacts to cultural resources. Adjustment of the mowing schedule and blade heights avoids the creation of bare spots, loss of vegetation, cutting into the earthworks, compaction from tractors, and rutting from farm equipment.

The selective removal of trees has negligible impacts to cultural resources. Hazardous trees would continue to be removed to prevent tree throws that would uproot the tree and a sizeable portion of soil. Trees would be cut at ground level and stumps treated with herbicide. Heavy equipment would be kept off earthworks or other known archeological sites to avoid site compaction.

Herbicide use does not have an effect on archeological resources but may hamper archeological investigations that use certain geophysical techniques. In particular, certain agricultural chemicals to control plants may affect conductivity readings (Clay 2001). It is unknown when conductivity readings return to normal but effects should be limited to the short term. Because park staff relies heavily on geophysical surveys to locate archeological resources, it is recommended that large-scale application of herbicides be kept to a minimum in areas without sufficient archeological surveys.

Under this alternative, all wildland fires would be suppressed. Depending on the severity of the fire, wildland fires can be extremely damaging to cultural resources. As such, importance must be placed on reducing hazard fuels and suppressing wildland fires. Hazard fuels management would continue to be accomplished by hand cutting and mowing. Impacts to cultural resources

from wildland fires would be minimized by immediately suppressing them. Wildland fires would use Minimum Impact Suppression Tactics to minimize the long-term effects of the suppression action. Suppression activities would be planned in conjunction with an archeologist to reduce or eliminate any impacts to earthworks or other archeological resources.

Based on the archeological literature, prescribed fires may impact cultural resources that are located on or below the surface. Thermal alteration of artifacts located on the ground surface may occur during a prescribed fire. Artifact class will, in part, determine the extent of thermal alteration of the artifact. Historic and prehistoric artifacts come in a variety of materials including stone, ceramic, metal, bone, and shell. Exposure of chert to a heat source may cause color change, increased luster, and reduced strength resulting in fractures. Iron and copper have established melting points above 900º Celsius, a temperature not likely reached during a prescribed burn. However, thermal cycling can contribute to corrosion of metal artifacts. Artifacts with organic components, such as bone, will exhibit charring and blackening on edges and surfaces. The color of pottery on the ground surface may be altered. Thermal alteration of cultural resources below the surface may also occur, even though the subsurface temperature during a prescribed burn in grasslands does not rise significantly over the baseline subsurface temperature. Surface heating beneath combusting logs or other areas of heavy fuel build-up may result in prolonged and sustained high temperatures that may affect subsurface cultural deposits. In addition, temperatures reached during prescribed fires can affect two methods used to date artifacts, thermoluminescence and obsidian hydration.

Additional concerns exist for prescribed fires conducted in forest environments. Discussions of prescribed fire as a management strategy stress that logs on the forest floor should be cleared before commencing a prescribed fire in forest cover. Hand-clearing of large fuel build-up, i.e. logs on the forest floor, would mitigate the damaging effects of the fire on subsurface cultural resources. However, clearing of the forest floor would increase soil erosion rates, especially on the earthworks. A critical factor in calculating the Universal Soil Lose Equation (USDA) is the presence of an intact forest floor (USDI, NPS 1998). Thus, soil erosion on earthen embankments in forests is controlled by maintaining an intact forest floor with the accumulation of leaf litter on the surface.

Prescribed fires may impact the ability to collect data with geophysical techniques, especially magnetometry. This technique measures the relative strength of the Earth's magnetic field. In February 2004 the park conducted an experimental study to determine the effects of prescribed fire on magnetometry at the Battelle-Darby Columbus Metro Park, Franklin County, Ohio. The area studied was previously burned in 1993, 1994, 1995, and 2001, a total of four prescribed fires in 10 years. NPS archeologists collected magnetic data in one 20 x 20 m area. Initial results suggest that annual prescribed burns have a negative impact on the ability to obtain reliable data on the presence or absence of buried archeological features. It appears that burnt residues accumulating on the surface from the annual prescribed burns acted as a barrier to detecting subsurface cultural features by obscuring geophysical anomalies, even though three years had passed since the last burn. More research is needed before concluding that prescribed fire interferes with geophysical techniques. Park staff have suggested conducting prescribed fires only on land without earthworks and where adequate survey, both archeological and geophysical, has been conducted.

Much of the land at Hopewell Culture contains the remnants of earthwork sites. Actions pertaining to vegetation management activities have the potential to effect archeological resources. However, current management practices, such as mowing, haying, cutting trees, and using herbicides, pose little to no threat to cultural resources if proper care is exercised. Wildland fire can damage cultural resources and must be immediately suppressed. Suppression activities can cause additional damage; however, the impacts from suppression activities would be mitigated to the extent possible in order to preserve cultural resources. Prescribed fires appear to impact cultural resources and archeological research using geophysical techniques. However, no literature exists on the latter subject such that a definitive answer is known. It is suggested that limited prescribed fires, restricted to areas with archeological inventories, be allowed in order to assess the effect. Thus, under this alternative the overall impact to cultural resources would be negligible to minor and short term, since the prescribed fires would only be allowed in areas without earthworks and with complete archeological inventories. No impairment of Park resources will occur as a result of adopting this alternative.

Impacts on Air Quality

Impacts to air quality were qualitatively assessed by means of a review of the literature and pertinent laws, guidance and regulations, consultation with experts and regulators, professional judgment, and experience with comparable actions.

The impact thresholds used for describing the effects on air quality of implementing the proposed FMP are as follows:

Negligible	No changes would occur or changes in air quality would be below or at the level of detection, and if detected, would have effects that would be considered slight, localized, and short-term.
Minor	Changes in air quality would be measurable, although the changes would be small, short-term, and the effects would occur in the park unit and adjacent properties. No air quality mitigation measures would be necessary.
Moderate	Changes in air quality would be measurable and would have consequences, although the effect would be limited to surrounding neighborhoods. Air quality mitigation measures would be necessary and the measures would likely be successful.
Major	Changes in air quality would be measurable, would have substantial consequences, and be noticed regionally. Air quality mitigation measures would be necessary and the success of the measures could not be guaranteed.
Impairment	The impacts to the Park's air resources are affected to the extent that the: (1) opportunities for using the Park resources or enjoying the Hopewell Culture are significantly diminished, or the air resources are affected to point of permanent or near permanent variance with the specific purposes identified in the establishing legislation or proclamation of the Park; (2) key to the natural or cultural integrity of the Park; or

(3) identified as a goal in the Park's general management plan or other relevant National Park Service planning documents.

Duration Short-term - Recovers in 2 days or less following a fire event.
Medium-term - Recovers in 3 to 6 days following a fire event.
Long-term - Takes more than 7 days to recover following a fire event.

Alternative A – No Action

Under Alternative A, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. Vegetation and hazard fuel management would continue to be accomplished by mowing , hand cutting, stump treatments, and chemical spraying. Prescribed fires would not be allowed. The Park would be fully compliant with DO-18.

Mechanical mowing and haying in limited areas would continue under this alternative. Operating machinery using internal combustion engines has the potential for increasing air pollution levels in certain areas. Of the five criteria pollutants monitored by the state of Ohio, sulfur dioxide ($S0_2$) and nitrogen dioxide ($N0_2$) are the two most prevalent air pollutants in Ross County. SO_2 is a particular concern to the Park because it can directly affect copper artifacts exposed to the pollutant in the air. As a result of Federal and State gasoline formulation requirements, SO_2 is no longer produced in appreciable quantities as a result of operating internal combustion engines in Ohio.

As the increased use of oxidizing agents in gasoline increases, $N0_2$ emissions have decreased. $N0_2$ is still produced by internal combustion engines but the amount contributed by mowing and haying within the Park is very small. Neither NO_2 nor SO_2 pollution are appreciably increased by the routine use of mowing and haying equipment at the Park. Mowing and haying operations and using motorized hand tools do not contribute significantly in a cumulative manner to local or regional degradation to local or regional air quality.

As noted above, all wildland fires would be suppressed and no prescribed fires would be used. Hazard fuels management would continue to be accomplished by hand cutting and mowing. Air quality impacts from wildfires would be minimized by immediately and aggressively suppressing them.

As explained above, the use of vehicles and gasoline powered hand tools in these suppression operations may have a slight negative effect on air quality but these effects will be of very short duration (up to one hour following the end of operating the machinery) and be very localized, being confined to the immediate area of the project. Because of this, the environmental impacts of adopting this alternative are expected to be negligible and short term. No impairment to Park resources will occur as a result of the adoption of this alternative.

Alternative B – Limited Prescribed fires (Preferred Alternative – Environmentally Preferred Alternative)

Under Alternative B, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. The majority of the vegetation management and hazard fuel management would continue to be accomplished by mowing, hand cutting, cut-stump herbicide treatments, and chemical herbicide spraying. Prescribed fires would be allowed on a very limited and restricted basis, being allowed only to evaluate their effects on archeological resources and on data collection. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Mowing and haying in limited areas would continue under this alternative, as is cutting brush and trees with gasoline powered hand tools. Operating machinery using internal combustion engines has the potential for increasing air pollution levels in certain areas. Of the five criteria pollutants monitored by the state of Ohio, sulfur dioxide ($S0_2$) and nitrogen dioxide ($N0_2$) are the two most prevalent air pollutants in Ross County. SO_2 is a particular concern to the Park because it can directly affect copper artifacts exposed to the pollutant in the air. As a result of Federal and State gasoline formulation requirements, SO_2 is no longer produced in appreciable quantities as a result of operating internal combustion engines in Ohio.

As the increased use of oxidizing agents in gasoline increases, $N0_2$ emissions have decreased. $N0_2$ is still produced by internal combustion engines but the amount contributed by mowing and haying within the Park is very small. Neither NO_2 nor SO_2 pollution are appreciably increased by the routine use of mowing and haying equipment at the Park. They do not contribute significantly in a cumulative manner to local or regional degradation to local or regional air quality.

The major difference in resource management operations under this alternative would be the opportunity to use prescription fire on a limited basis for assessing the effects of fire on archeological resources and on data collection. Only after determining that prescribed fire is safe and effective and is not potentially damaging to resources or to the ability to collect data would prescribed fire be used on a more Park-wide scale.

Prescribed fires produce smoke and therefore have a negative effect on air quality. Hopewell Culture will monitor meteorological conditions (especially wind direction) when scheduling and during prescribed fires to prevent smoke from drifting into sensitive receptors, such as schools, hospitals, across highways, residences, and other sensitive areas. In order to ensure proper smoke dispersion in smoke-sensitive areas, the Park will control the rate of smoke emissions by scheduling prescribed fires when weather systems develop instability in air layers and when subsidence inversions are absent.

If weather conditions changed unexpectedly during a prescribed fire and there is a potential for adverse smoke impacts to sensitive receptors, the Park would implement a contingency plan, which may include the immediate suppression of the fire. This alternative is expected to have negligible to minor effects of short duration on the air quality at Hopewell Culture and the surrounding area. Adopting this alternative will not impair Park air resources.

Other actions proposed under this alternative, such as the use of pesticides for invasive weed control, are not expected to affect air quality in any manner. Because of this, the environmental impacts of adopting this alternative are expected to be minor and short term. No impairment to Park resources will occur as a result of the adoption of this alternative.

Impacts on Park Facilities, Operations, and Visitor Use

Impacts to the Park facilities, operations, and visitor use were assessed qualitatively by using professional judgment, experience, and discussions with Park officials, to predict the likely effects of wildland fires, prescribed fires, and fire suppression on facilities, operations, and visitor use, based on known characteristics fire management and fire suppression.

The impact thresholds used for describing the effects on Park facilities, operations, and visitor use of implementing the proposed FMP are as follows:

Negligible	Operations and visitor use would not be affected or changes in visitor use and/or experience would be below or at the level of detection. Any effects would be short-term. The visitor and most employees would not likely be aware of the effects associated with the alternative.
Minor	Changes in operations and visitor use and/or experience would be detectable, although the changes would be slight and likely short-term. The visitor would be aware of the effects associated with the alternative but the effects would be slight.
Moderate	Changes in operations and visitor use and/or experience would be readily apparent and likely long-term. The employees and visitor would be aware of the effects associated with the alternative and visitor experience and employee schedules and work assignments would likely be affected.
Major	Changes in visitor use and/or experience would be readily apparent and have important long-term consequences. The visitor would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes.

Duration	Short-term – Burned areas recovers in less than 6 months to pre-fire conditions. Mowed areas are impacted only during active mowing. Medium-term – Operations and visitor experience recovers to pre-fire conditions in 6 months to one year after a fire. Mowing should not result in medium-term impacts. Long-term - Takes more than 1 year to recover to pre-fire conditions. Mowing should not result in long term impacts to park operations.

Alternative A – No Action

Under Alternative A, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. Vegetation and hazard fuel management would continue to

be accomplished by mowing, hand cutting, stump treatments, and chemical spraying. Prescribed fires would not be allowed. The Park would be fully compliant with DO-18.

Under Alternative A, the Park would adopt a new Fire Management Plan. It would continue to operate and manage resources relying solely upon the existing Vegetation Management Plan and Resource Management Plan for guidance regarding vegetation and fire management. All wildland fires would be immediately extinguished. No prescribed fires, including those designed to evaluate the effects of fire on archeological resources or its effect on resource data collection, would be allowed to be ignited within the Park.

Vegetation management operations, such as mowing and haying, would continue unchanged under this alternative. Mowing operations would continue during the summer months at the Mound City Group unit, which is where the majority of the Park visitors confine their visits. The earthworks are covered by an established grass lawn that would be mowed regularly, and an area north of the administrative area and earthworks would continue to be cut for hay. Removal of invasive woody vegetation and exotic weed control activities would take place during regular operating hours at mound city with only minimal temporary disruption of visitor services and operations expected.

The Seip Earthworks unit is managed in conjunction with the Ohio Historical Society and the Ohio Department of Transportation. Since this unit is located on US Highway 50, and there are at least some visitor facilities, it is visited on an occasional basis by school groups and incidental visitors. The unit would continue to be regularly mowed and maintained to present an overview of the existing earthworks. Mowing, controlling exotic weeds, removing encroaching woody vegetation, and maintaining the minimum visitor facilities would continue to takes place during normal visitor hours. Only the minimum disruption in visitor services is expected as a result of adopting alternative A.

The Hopewell Mound Group units has an interpretive display and is served by a trail, but as yet is not visited regularly. Ranger guided school groups and occasional casual visitors make up most of the public use of this unit. Mowing and woody vegetation control would continue to occur during regular operating hours with very little disruption of visitor services.

The Hopeton Earthworks and High Bank Works units are not open to the general public and receive only minimal visitor use, usually in the form of special guided school groups and seminars. Mowing would be completed only occasionally, and woody vegetation control would be completed during regular operating hours. No visitor services would be disrupted as a result of adopting this alternative.

The impacts to Park operations and visitor services as a result of adopting this alternative are expected to be negligible and short term.

Alternative B – Limited Prescribed fires (Preferred Alternative – Environmentally Preferred Alternative)

Under Alternative B, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. The majority of the vegetation management and hazard fuel management would continue to be accomplished by mowing, hand cutting, cut-stump herbicide treatments, and chemical herbicide spraying. Prescribed fires would be allowed on a very limited and restricted basis, being allowed only to evaluate their effects on archeological resources and on data collection. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

Mowing and haying would continue to be the dominant vegetation management methods under this alternative. Mowing operations would continue during the summer months at the Mound City Group unit, which is where the majority of the Park visitors confine their visits. The earthworks are covered by an established grass lawn that would be mowed regularly and an area north of the administrative area and earthworks would continue to be cut for hay. Removal of invasive woody vegetation and exotic weed control activities would take place during regular operating hours at Mound City Group with only minimal temporary disruption of visitor services and operations expected.

Prescribed fire would be allowed under this alternative. At the Mound City Group unit, prescribed fire would likely be confined to the hay field to the north and the natural resource zones (trees) south of the hay field and along the Scioto River. A prescribed fire would likely disrupt visitor services during the prescribed fire, as visitors would have to be excluded from the burn area. In addition, qualified personnel would be used on and in direct support of prescribed fire crews, which would limit normal Park operations. However, prescribed fires would likely take place in the early spring or late fall, when visitation is low, and therefore would result in fairly limited visitor services disruption. In addition, a prescribed fire at the Mound City Group would afford an excellent opportunity for the interpretation of fire ecology both during a burn and long term following a burn.

The Seip Earthworks unit is managed in conjunction with the Ohio Historical Society and the Ohio Department of Transportation. Since this unit is located on US Highway 50, and there are at least some visitor facilities, it is visited on an occasional basis by school groups and incidental visitors. The unit would continue to be regularly mowed and maintained to present an overview of the existing earthworks. Mowing, controlling exotic weeds, removing encroaching woody vegetation, and maintaining the minimum visitor facilities would continue to takes place during normal visitor hours. Only the minimum disruption in visitor services is expected as a result of adopting alternative B.

A prescribed fire at the Seip Earthworks unit would likely disrupt visitor services during the burn, as visitors would have to be excluded from the burn area. Qualified personnel would be used on and in direct support of prescribed fire crews, which would somewhat limit normal Park operations. However, prescribed fires would likely take place in the early spring or late fall, when visitation is low and therefore would result in fairly limited visitor services disruption. In

addition, a prescribed fire at the Seip Earthworks Unit could afford an excellent opportunity for the interpretation of fire ecology both during a prescribed fire and long term following a burn.

The Hopewell Mound Group Unit has an interpretive display and is served by a trail, but as yet is not visited regularly. Ranger guided school groups and occasional casual visitors make up most of the public use of this unit. Mowing and woody vegetation control would continue to occur during regular operating hours with very little disruption of visitor services.

A prescribed fire at the Hopewell Mound Group unit would likely disrupt visitor services during the burn, as visitors would have to be excluded from the burn area. Qualified personnel would be used on and in direct support of prescribed fire crews, which would somewhat limit normal Park operations. However, prescribed fires would likely take place in the early spring or late fall, when visitation is low, and therefore would result in fairly limited visitor services disruption. In addition, a prescribed fire at the Hopewell Mound Group unit could afford an excellent opportunity for the interpretation of fire ecology both during a burn and long term following a burn.

The Hopeton Earthworks and High Bank Works units are not open to the general public and receive only minimal visitor use, usually in the form of special guided school groups and seminars. Mowing would be completed only occasionally, and woody vegetation control would be completed during regular operating hours. No visitor services would be disrupted as a result of adopting this alternative.

A prescribed fire at the Hopeton Earthworks and High Bank Works units could disrupt visitor services at the other units during the burn, as qualified personnel would be used on and in direct support of prescribed fire crews, which would limit their availability for other work. However, prescribed fires would likely take place in the early spring or late fall, when visitation is low, and therefore would result in fairly limited visitor services disruption. Overall a prescribed fire at the Hopeton Earthworks and High Bank Works units would result in very limited disruption of visitor services and Park operations.

Generally, disruption of visitor services and Park operations would be affected only slightly as a result of adopting this alternative. Prescribed fires would require Park personnel to be assigned to work away from their regular duties and visitors would be excluded from areas being burned. However, because of the expected timing of prescribed fires at the Park, disruptions would affect only a small number of visitors. The impacts to Park operations and visitor services as a result of adopting this alternative are expected to be negligible and short term.

Impacts on Health and Safety

Impacts on health and safety were assessed qualitatively by examining information on local land use patterns and their relation to Park units, and predicting the likely physical effects of wildland fires, prescribed fires, and fire suppression on health and safety.

The impact thresholds used for describing the effects on Health and Safety of implementing the proposed FMP are as follows:

Negligible	Public health and safety would not be affected or the effects would be at low levels of detection and would not have an appreciable effect on the public health or safety.
Minor	The effect would be detectable and would likely be short-term but would not have an appreciable effect on public health and safety. If mitigation were needed, it would be relatively simple and would likely be successful.
Moderate	The effects would be readily apparent and long-term and would result in substantial, noticeable effects to public health and safety on a local scale. Mitigation measures would probably be necessary and would likely be successful.
Major	The effects would be readily apparent and long-term and would result in substantial, noticeable effects to public health and safety on a regional scale. Extensive mitigation measures would be needed and their success would not be guaranteed.

Duration	Short-term – Effects last one year or less. Long-term – Effects last longer than one year.

Alternative A – No Action

Under Alternative A, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. Vegetation and hazard fuel management would continue to be accomplished by mowing, hand cutting, stump treatments, and chemical spraying. Prescribed fires would not be allowed. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

This alternative includes mowing and haying in limited areas, cutting woody vegetation, and handling chemical herbicides. Each of these activities involves the operation of machinery and hand tools and is similar at all Park units. Injuries to Park employees can occur from the improper or careless use of power equipment and hand tools as well as from traveling to and work areas. While each of the crew is trained in the use of equipment, accidental injuries may occur from time to time. Strict adherence to guidelines concerning equipment training, procedures and safety guidelines will minimize accidents. Accidents as a result of operating equipment involving visitors have been, and are expected to be, extremely rare.

Other factors most likely to adversely impact workers health and safety include activities associated with wildland fire suppression efforts, including accidental fuel spills, injuries from the use of firefighting equipment and machinery, smoke inhalation, and, in severe cases, injuries from the wildland fires themselves. Impacts to the public could include smoke inhalation, and in severe cases, injuries from wildland fires.

Injuries from the use of hand tools and machinery during firefighting activities and from accidental spills of fire retardants and foams are the most likely to adverse impact human health and safety. While each of the crew is trained in the use of equipment and materials, accidental injuries may occur from time to time. Proper training, strict adherence to guidelines concerning firefighter accreditation, and equipment and procedure safety guidelines will minimize accidents.

Smoke inhalation can pose a threat to human health and safety. Smoke from wildland fires is composed of hundreds of chemicals in gaseous, liquid, and solid forms. However, based on a recent study of firefighter smoke exposure, most smoke exposures were not considered hazardous. A small percentage routinely exceeded recommended exposure limits for carbon monoxide and respiratory irritants (USDA 2000). Firefighters tend to avoid or move away from areas of the heaviest smoke, especially at the head of a moving fire.

Alternative B – Limited Prescribed fires (Preferred Alternative – Environmentally Preferred Alternative)

Under Alternative B, the Park would adopt a new FMP that encompass all of the requirements and provisions outlined in DO-18. The majority of the vegetation management and hazard fuel management would continue to be accomplished by mowing, hand cutting, cut-stump herbicide treatments, and chemical herbicide spraying. Prescribed fires would be allowed on a very limited and restricted basis, being allowed only to evaluate their effects on archeological resources and on data collection. The Park would adopt the provisions and requirements of DO-18 and the Park would be fully compliant.

This alternative includes mowing and haying in limited areas, cutting woody vegetation, and handling chemical herbicides. Each of these activities involves the operation of machinery and hand tools and is similar at all Park units. Injuries to Park employees can occur from the improper or careless use of power equipment and hand tools as well as from traveling to and from work areas. While each of the crew is trained in the use of equipment, accidental injuries may occur from time to time. Strict adherence to guidelines concerning equipment training, procedures and safety guidelines will minimize accidents. Accidents as a result of operating equipment involving visitors have been, and are expected to be, extremely rare.

Other factors most likely to adversely impact workers health and safety include activities associated with wildland fire suppression and prescribed fire activities, including accidental fuel spills, injuries from the use of fire-fighting equipment and machinery, smoke inhalation, and, in severe cases, injuries from the fires themselves. Impacts to the public could include smoke inhalation, and in severe cases, injuries from wildland fires.

Injuries from the use of hand tools and machinery during firefighting activities and from accidental spills of fire retardants and foams are the most likely to adverse impact human health and safety. This is also true of activities that occur in preparation of prescribed fire and during the prescribed fire itself. While each of the crew is trained in the use of equipment and materials, accidental injuries may occur from time to time. Proper training, strict adherence to guidelines concerning firefighter accreditation, and equipment and procedure safety guidelines will minimize accidents.

Smoke inhalation can pose a threat to human health and safety. Smoke from wildland and prescribed fires is composed of hundreds of chemicals in gaseous, liquid, and solid forms. However, based on a recent study of firefighter smoke exposure, most smoke exposures were not considered hazardous. A small percentage routinely exceeded recommended exposure limits for

carbon monoxide and respiratory irritants (USDA 2000). Firefighters tend to avoid or move away from areas of the heaviest smoke, especially at the head of a moving fire.

Hopewell Culture will monitor meteorological conditions (especially wind direction) when scheduling and during prescribed fires to prevent smoke from drifting into sensitive receptors, such as schools, hospitals, across highways, residences, and other sensitive areas. In order to ensure proper smoke dispersion in smoke-sensitive areas, the Park will control the rate of smoke emissions by scheduling prescribed fires when weather systems develop instability in air layers and when subsidence inversions are absent.

If weather conditions changed unexpectedly during a prescribed fire, and there is a potential for adverse smoke impacts to sensitive receptors, the Park would implement a contingency plan, which may include the immediate suppression of the fire.

All areas where wildland and prescribed fires are occurring would be closed to the public to minimize or eliminate public human health and safety concerns resulting from smoke exposure and fire injuries. This alternative is expected to have negligible to minor effects on the health and safety of Park visitors, neighbors, and employees at Hopewell Culture and be of short duration.

CONSULTATION AND COORDINATION

Summary of Public Involvement

Copy of news release announcing preparation of fire management plan

NEWS RELEASE

For Immediate Release

September 30, 2004
Contact: Dean Alexander, 740/774-1126

Hopewell Culture National Historical Park preparing Fire Management Plan

Chillicothe, OH-Superintendent Dean Alexander announced that Hopewell Culture National Historical Park is preparing a Fire Management Plan for the response to and suppression of wildland fire, and use of prescribed fire on the five units of the park. This fire management plan (FMP) will implement fire management policies and help achieve fire management goals defined in: (1) Federal Wildland Fire Management Policy and Program Review (1995); (2) Managing Impacts of Wildfires on Communities and the Environment, and Protecting People and Sustaining Resources in Fire Adapted Ecosystems – A Cohesive Strategy (USDOI/USDA), 2000; (3) A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10 Year Comprehensive Strategy Implementation Plan (2001); and (4) Review and Update of the 1995 Federal Wildland Fire Management Policy, (2001).

This fire management plan contains the following program direction:

To guide the decision-making process where safety, social, political, and resource values are evaluated, and appropriate management response strategies are identified for wildland fires.

To provide a framework for fuels management strategies through the use of prescribed fire, mechanical, and chemical treatments.

To provide a platform to cooperate more fully in planning and implementing a wildland fire program across agency boundaries.

Program operations included in the plan are preparedness, prevention, suppression, and fuels management. Applicable resource goals and objectives are derived from approved agency resource and general management plans. These goals may include prescribed fire to control fuel build up and control of woody vegetation and invasive weeds.

Public scoping is a part of environmental compliance process required before the project can be accomplished. The NPS invites and welcomes comments during this early planning stage of the process. Public comments will help park managers make well-informed decisions about whether and how to precede with this project. The information received during scoping will help with the preparation of an Environmental Assessment (EA) to investigate the potential for effects on park resources. The EA should be released for public comment by this autumn.

Please submit your comments by November 1, 2004 using one of the following methods:

Postal Mail
Dean Alexander, Superintendent
Hopewell Culture NHP
16062 State Route 104
Chillicothe, OH 45601-8694

E-Mail
HOCU_superintendent@nps.gov

Phone
740-774-1125

Phone Call from Mrs. Shoup, park neighbor

Memo to files

Phone conversation with Mrs. Shoup, homeowner at Seip Earthworks Unit, Oct. 6, 2004.

Mrs. Shoup called after receiving the scoping notice by mail. She expressed concerns about smoke and danger to her propane tank.

I explained that we were still considering a range of alternatives, including no use of fire. She stated that she would prefer that alternative.

APPENDIXES / BIBLIOGRAPHY / PREPARERS

Appendixes

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Preparers and Consultants

Midwest Regional Office

Fred Bird, Fire Management Officer
Jim DeCoster, Ecologist
Rod O'Sullivan, Environmental Protection Specialist

Hopewell Culture National Historical Park

Dean Alexander, Superintendent
Kathleen Brady-Rawlins, Archeological Technician
Jon Casson, Maintenance Worker Supervisor
Jennifer Pederson, Archeologist
Myra Vick, Biologist

Other Consultants

Dan O'Brien, Wildland Fire Associates, Rangely, Colorado